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New Zealand Geographer

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WEST WIND, EAST WIND*

KEITH BUCHANAN

> Nous sommes passés, en trente années ponctuées de catastrophes, d'un type d'organisation du monde à un autre type que définit surtout la primauté géographique absolue des États et des frontières.—M. le Lannou

THE title of this address does not mean that I have quitted my chosen field of geography for the delights of climatology, nor does it represent an environmentally-triggered reaction against seven long years in the city of southerlies. It is taken, more prosaically, more provocatively, from the Chinese propaganda slogan 'The East Wind prevails over the West'. The slogan refers, very obviously, to the rapidly increasing economic and political power of the East bloc, or the Socialist camp, *vis-à-vis* our Western world. This is one of the great changes of our time, indeed, it is one of the great turning-points in history. If I may use the climatological metaphor, this wind shift, as the storm centre of the second World War recedes, is bringing new, and, for some, more glacial, conditions. Out of these conditions arise major problems of political, economic and social readjustment so that we live in a world of continuing crisis and tension. Perhaps ultimately we shall be forced by these challenges to a drastic re-examination of our whole Western way of life, of our political, social and economic values, of our concept of the Good Life and the aims and the adequacy of the educational system which should open for us the way to such a life.[1] Perhaps we will not have the courage to make such a re-examination, preferring to stumble from crisis to crisis and ultimate calamity.

Whatever course we choose one thing is certain: that those changes which are forcing the West to 'an agonising reappraisal' of its role and its values are profoundly influencing those intellectual disciplines by which we seek to interpret the world. It is inevitable that geography, concerned more than any other discipline with an interpretation of the relationships between man and the earth, should feel these changes. It was indeed inevitable that the methods and the techniques formulated to interpret a gradually-evolving European scene should prove inadequate for the interpretation of a new, swiftly-changing world scene, characterised by a new dynamism in the relationships of man to the earth, by the emergence of old cultures and new ideologies and by the growing interdependence of peoples. A geography conceived as a 'study of areal differentiation' or as 'a study of the discovery, identification and explanation of earth patterns' is no longer satisfying, for such a study cannot give adequate weight to the accelerating, expanding and *planned* transformation of the environment by man. Above all, it provides a completely inadequate basis for the interpretation and understanding of the geography of those socialist and planned societies whose rise has been one of the most striking features of the postwar period and which today contain one third of humanity.

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*The Presidential Address delivered to the Third New Zealand Geography Conference at Palmerston North, 21 August 1961.

[1] See M. Lambilliotte: 'Refonte des structures', *Synthèses*, Brussels, July-August 1959, pp. 309-318; and E. P. Thompson (Ed.): *Out of Apathy*, London, 1960.

Today I want to comment on some aspects of the geography of the Socialist bloc countries because I believe that the study of these countries draws attention to some of the weaknesses of what I may term 'orthodox geography', and because such a study serves to indicate some of the directions in which geography must inevitably move if it is to contribute significantly to our understanding of the world about us.

The Shift towards Collectivism

The American economist, Robert Heilbroner,[2] claims that the overriding fact of our era is a 'basic change in the economic orientation of the world. . . . It can be described as the collectivization of twentieth-century economic life.' He goes on: 'Over the larger part of our history, we have faced a future in which our own form of economic organization, capitalism, was the triumphant and dominant form of economic and social organization in the world. This is no longer true. Today and over most of the foreseeable future, traditional capitalism throughout the world has been thrown on a defensive from which it is doubtful that it can ever recover.'

This 'collectivism' shows itself in the growth of public control and intervention in a wide range of social and economic fields and in the increasing importance of planning as an integral part of the economic system. Such control, intervention and planning are distinguishing features of the countries of the Sino-Soviet bloc. What we tend to forget is the extent to which in the West 'socialist' mechanisms of planning are used to buttress, indeed to ensure the survival of, essentially capitalist social and economic structures. The British *managed economy*, the French *économie dirigée*, the German *soziale Marktwirtschaft* are clearly examples, however mild, of the shift towards national economic collectivism. And does not the rise of the European Economic Community represent a continuation of this same trend on a vaster, continental scale?

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[2] R. Heilbroner: *The Future as History*, New York, 1960, pp. 93-94.

GROWTH IN COLLECTIVIST SOCIETIES

Today, fully collectivist societies contain over one thousand million people and represent, in terms of population, the largest homogeneous grouping of societies in the world. Their rise has been sudden and swift. The proportion of the world's population living in socialist states has increased from about one tenth in prewar days to one third in 1959. The Socialist camp's share of the world's coal output has risen, over the same period, from 2.7 percent to 49.8 percent, of steel production from 4.0 percent to 30.9 percent, of cotton fabrics from 8.8 percent to 35.0 percent.[3] This trend is not likely to be reversed. Indeed, what is more likely is a widening differential between the rates of economic development in the socialist camp and the capitalist world and the increasing geographical expansion of the socialist bloc as a result of a swing to the left in the newly emergent nations of Africa, Asia and Latin America.

Between 1951 and 1959 the average annual rate of growth of industrial output was 13.7 percent for the socialist countries as compared with 4.8 percent for the capitalist countries and, given present trends, by 1965 the Socialist bloc will be producing more than one half of the world's industrial output. Comparing the U.S.A. and U.S.S.R., Allen Dulles commented: 'the Soviet economy has been growing and is expected to grow through 1962 at a rate roughly twice that of the economy of the United States'.[4] The lesson contained in these statistics is not likely to be lost on the underdeveloped and uncommitted third of mankind, for these face today the same problems as Russia in 1917, China in 1949 and Cuba in 1959. They face shortages of capital, of skills, of power; they face the problem of unbalanced economies, often manipulated by foreign interests. They can develop only if their economic surplus is properly mobilised, and without centralised control over the economy—in other words, without planning—this is impossible. Moreover, the frustratingly slow pace of development under free enterprise conditions will tend to push these societies increasingly to the extreme left. The desperate hunger of folk in the underdeveloped lands to attain a better and fuller life—and, above all, attain it quickly—will thus push many emergent nations towards a socialist type of society.[5]

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[3] 'Economic Development of the Socialist Countries', Supplement to *World Marxist Review, Problems of Peace and Socialism*, London, January 1961.

[4] Quoted by Heilbroner: *op. cit.*, p. 88.

Under these conditions the world which we as geographers may have to interpret by the end of this decade may well be one in which our Western free-enterprise system has become an enclave and which, in terms of population, production, or even geographical area, is dominated by the Socialist sector.

Tomorrow is already Here

I think it is not unfair to assert that our 'orthodox' geography is one which has developed to describe the landscapes which have emerged, *gradually*, as the result of the more or less unfettered play of the free-enterprise system or the again gradual retouching and remodelling of these landscapes by an economic system increasingly but unevenly penetrated by 'socialist' elements. It is a geography perhaps adequate to portray developed economies and their expression in the landscape. It can adequately describe the characteristic features of the static and dominantly agrarian economies of the colonial territories. But it is quite inadequate to describe or interpret the swiftly changing geography of the socialist world or the emergent ex-colonial territories. Thus, there is, as far as I am aware, no satisfactory geography in English[6] of the Peoples Democracies of East Europe, while one of the latest American texts on Asia[7] gives an utterly inadequate account of the sweeping transformation of the Chinese scene since the People's Government came to power; much of the statistical data is pre-1949 and the accounts of China's minority peoples are pre-1939. The teaching of the geography of contemporary Africa presents major difficulties at every level; such geographies of the continent *as a whole* as are available are either revisions of prewar texts or hastily compiled syntheses; more recent *regional* studies are purely descriptive and, because of their sketchy treatment of the human geography, provide little basis for an understanding of the new Africa.

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[5] 'The social revolution in Asia, Africa and Latin America . . . is a revolution of the hungry countries against the industrially advanced: more especially, a revolution against the old structure of imperialism and therefore profoundly hostile to capitalism as an economic system' (S. Hall and N. Fruchter: 'Notes on the Cuban Dilemma', *New Left Review*, May-June 1961, p. 2).

[6] In French there are satisfying analyses by Marxist geographers such as Pierre George.

[7] N. S. Ginsburg, (Ed.): *The Pattern of Asia*, London, 1958.

If we seek the reasons for this weakness of modern geography, for its depressing failure to measure up to the challenge of a world in flux, I think we can find two explanations: first, the geographer's almost obsessive avoidance of political or ideological matters; second, his preoccupation with description, with the static aspects of the world scene. The avoidance of political matters is largely a 'cultural hang-over', a legacy from the days when the geographer was concerned with states whose pattern was 'liberal-democratic'; in such states, by definition, most of the economic life lay outside the sphere of government control. Today, in the socialist countries, the state plays a direct role in guiding and controlling economic development; it has become, in short, a major geographic factor; as Maurice le Lannou puts it: 'the state has asserted itself as the most coherent and most effective human group'[8] and its political philosophy determines in large measure the degree and the direction of the transformation of the landscape. There can be few sharper geographic contrasts than those which have emerged between the Democratic Republic of Vietnam on one hand and American-oriented South Vietnam on the other; between North Korea and South Korea, or between the German Democratic Republic and Western Germany. These contrasts have developed as a result of political forces and any geographic analysis of these countries which ignores the political factor cannot but be incomplete and superficial. Moreover, even outside the Socialist bloc, increasing government intervention in many fields of national life[9] makes it increasingly impossible to ignore political forces. If some of the recent work by geographers on the Italian South or the South African Republic seems shallow or lacking in conviction it is precisely because they *do* ignore such forces.

PREOCCUPATION WITH DESCRIPTION

The second weakness I see arising is from the view that the geographer's concern is with 'what places are like'. Again, I see this as a cultural hangover from days when the world was more settled, the pace of change relatively leisurely, when, conveniently but unforgivably, three-quarters of the world was left to stagnate under colonial or semicolonial conditions. Then, it was perhaps easy to describe what places were like. Today, the problem is more difficult. What *is* Africa like today? What *is* the geography of the Republic of Guinea? What *is* China like? And when you pose that question do you mean Cressey's China which is still the 'Land of the Five Hundred Million'—and of seventeen or twenty-seven physiographic provinces tenuously linked to the human realities of the country? Or do you mean the China of Mao Tse-tung and Liu Shao-chi? And if the latter, the China of 1958, or 1960, or 1961? Which China is like what? The process of change in China, or Africa, or Cuba today is so swift that any geographic account may well resemble one shot extracted from a movie film—with all that implies in incompleteness. . . .

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[8] M. le Lannou: *La géographie humaine*, Paris, 1949, p. 218.

[9] In the United States the government sector comprises between 20 and 25 percent of the economy (Heilbroner, *op. cit.*, p. 145).

The growing 'socialisation' of the world—and I include under this term the shift towards some measure of planning and direction even in capitalist societies—may be most significant to geographers in this context. This shift implies that, even though our study may be but one shot in a movie sequence, we nevertheless have some guide as to the subsequent unfolding of that sequence. Our picture will obviously be least incomplete in those fully socialist economies whose objectives are clearly expressed in state plans of varying duration: five years, seven years, twelve years, or more recently, in the U.S.S.R., even longer-range plans. These tell us in very definite terms the goals of development, the rate of expansion of the total economy, the relative pace of development of the various sectors and of the industries in each sector, and finally, the pattern of location which these industries will follow (for this pattern follows more or less clear-cut politico-economic rules). Such a plan, as Pierre George observes, is not a sum but 'a whole economic universe whose rhythm and equilibrium must be assured at the beginning and re-established during its course in the case of inharmonious development of different sectors'.[10] But, and this is important to us as geographers, we must understand clearly the point of departure in such planned economies and we must understand and concern ourselves even more with the direction and purpose of development and the ultimate goals. And, under these circumstances, we must move increasingly away from a purely static and descriptive type of geography.

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[10] P. George: *U.S.S.R., Haute-Asie, Iran*, Paris, 1947, p. 254.

'Pioneering a New Frontier'

Here, as I see it, is a major challenge to the geographer. If we are to make any contribution to the understanding of the world today—and we *do* have a contribution to make—it can scarcely be in the direction of the 'what-places-are-like' kind of geography. We have got to range widely and deeply, through the deserts of statistics, through the tangled savanas of history and prehistory, through the fetish-ridden forests of anthropology, and over the grudging and skeletal soils of the geomorphologist. And, as we journey, we may attain some understanding of the processes and forces which, year by year and day by day, transform the geographic scene. Instead of a description outdated even when written, instead of an untidy mass of facts which refuses to fit into our preconceived 'regional' frameworks, far better some understanding of the social and economic and political forces at work, forces which find expression in the present-day landscape, forces which all the time are transforming the landscape.

Put more explicitly, I think the geographer has got to shift from his pleasantly comfortable and static view of geography to a dynamic view. Such a shift is partly necessitated by our increasing preoccupation with the non-European world and by the 'protean' quality of the Asian or African or Cuban scene, but it is equally called for if we are to understand the European, American or Soviet scene. Braverman[11] makes the point that 'none of the disciplines of learning have been able to attain to the full stature of a science until they have moved from statics to dynamics'. In most academic disciplines, he observes, 'dynamics is the key to statics, as the isolated phenomenon can be only half comprehensible apart from the study of its origin and development, its transformation out of earlier material and into a later form'. This applies to geography no less than to the other social sciences, to physics, or to biology.

Our subject, then, must become something more than a 'study of human groups in their environmental setting'; it must become a study of the *changing* interrelations between societies and their environment.

Ideology into Landscape

Let me illustrate my remarks about a 'dynamic geography' resting on an understanding of the social, political and economic forces which are shaping the landscape of the world in which we live by referring again to the countries of the Socialist camp.

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[11] H. Braverman: 'The Momentum of History', *Monthly Review*, New York, April 1960, p. 434.

Among the outstanding features of these countries I would include the following:

(a) The rapid expansion of their gross output which is bringing about a significant shift in the centre of gravity of the world economy.

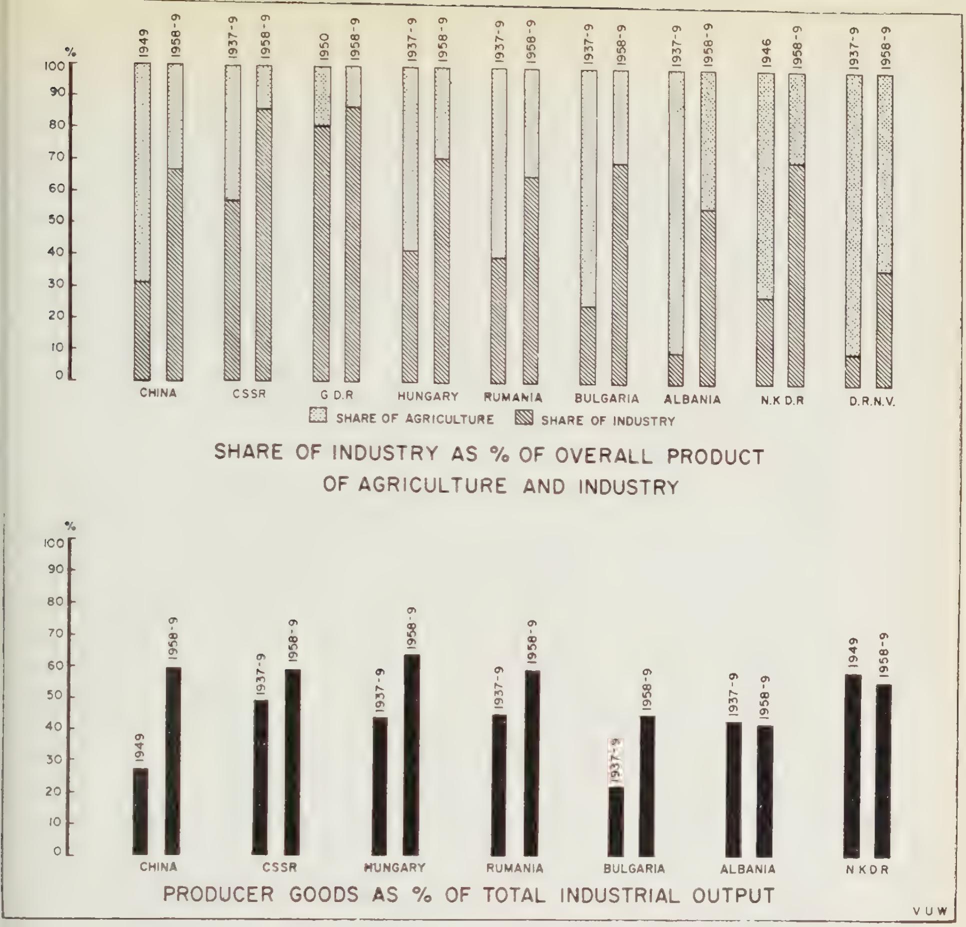
(b) Significant changes in the structure of their economies as a result of the massive drive for industrialisation; these are summarised in Figure 1.

(c) The emergence of new patterns of agriculture and industry, and of population distribution, on a carefully planned basis.

In spite of widely differing earlier histories and in spite of considerable resource differentials between the various countries, the general pattern of development emerging is strikingly similar. In the agricultural field collectivisation in varying forms has reshaped the rural landscape and removed some of the barriers to mechanisation; expansion of agricultural output represents one means of accumulating capital for industrialisation. The Soviet policy of industrial development in a series of giant industrial complexes scattered throughout the state territory is being followed by China (Wuhan, Paotow, Lanchow, Sian, Chengtu-Chungking and Urumchi-Karamai) and the East European states. In the cultural-political field the minority policy of the Soviet Union of granting local self-government (as Autonomous Regions or National Areas) to compact minority groups is being followed by Yugoslavia (autonomous areas of Voivodina and Kossovo-Metohija), by China (Sinkiang, Inner Mongolian and Kwangsi Autonomous Regions and others), and by North Vietnam.

'Objective Laws of Socialist Production'

If the policy towards minority peoples follows closely the lines laid down by Lenin the new patterns of industry share equally a common inspiration, arising out of the five 'objective laws of socialist production'. These are: first, the closest possible *rapprochement* between the centres of production and the sources of raw materials and the markets—this makes possible more effective use of resources and the rationalisation of transport, and this permits in turn considerable savings in labour and an increase in production; second, accelerated development of the areas inhabited by minority groups in order to



SHARE OF INDUSTRY AS % OF OVERALL PRODUCT OF AGRICULTURE AND INDUSTRY

PRODUCER GOODS AS % OF TOTAL INDUSTRIAL OUTPUT

Fig. 1. Changes in the structure of the economies of socialist countries (N.K.D.R.—North Korea Democratic Republic, D.R.N.V.—Democratic Republic of North Vietnam)

remove existing economic inequalities; third, planned division of labour between the various economic regions through complex development of the economy of each region—this implies a measure of economic self-sufficiency, at least for basic products, for each region and makes possible full use of local raw materials and a considerable economy in transport; fourth, planned distribution of industry over the state territory so that new towns and industrial centres are developed in formerly backward agrarian areas—with this goes a deliberate policy of bridging the gulf between agriculture and industry; and last, the strengthening of the country's defensive capacity—surrounded by hostile capitalist countries it is imperative, for defensive reasons, to push ahead with the rapid industrialisation of less vulnerable interior districts.[12] It will be noted that of these five precepts only two, the first and the third, are based solely on economic considerations.

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[12] Paraphrased from B. Grossman: *Die Wirtschaftliche Entwicklung der Volksrepublik China*, Stuttgart, 1960, pp. 167-168.

The *means* employed by the various countries of the Socialist bloc to accelerate their economic development likewise follow a similar pattern in each country. They include: the more thorough use of the state's material and human resources; the concentration of the state's energies, initially at least, on a limited number of objectives whose attainment is regarded as a major priority; a drastic reduction of the relative share of consumer goods in the national economy; finally, close collaboration and a measure of rationalisation of production between the various socialist countries. Their *success*, compared with the meagre success achieved by earlier governments, has been due in large measure to the fact that they possess 'a doctrine . . . which permits them to define exactly the objectives of their action and which gives their efforts a cohesion and a continuity of which no prewar government was capable'.[13] It is due also to their unshakable determination to attain their defined objectives and to the fact that they possess methods and means of action to implement their decisions.

Need for Industrialisation

The ideological elements in the emergence of the new geographies of the socialist countries have been commented on by Marczewski. He says: 'Whatever one's opinion of Marxist-Leninist-Stalinist doctrine it is certain that it has clearly defined objectives capable of mobilising and directing all energies towards a single goal. This goal, the building of socialism, calls for the industrialisation of the country, firstly, because industrialisation strengthens the working class, secondly because . . . industrialisation represents the only way of avoiding exploitation by the capitalist countries. This industrialisation is to be achieved above all by the creation of heavy industry which is the basis of all economic development and which furnishes the means of defence against capitalist encirclement. The thirty years of Soviet experience have made it possible to incorporate in this doctrine a whole political, social and economic methodology which furnishes ready-made solutions to a great number of practical problems. . . . The resultant unity of action is a considerable force since it makes it possible to utilise in positions of control the millions of primary students who would otherwise be incapable of fulfilling their mission. In this methodology planning plays a preponderant role.'[14]

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[13] This and preceding quotation are from J. Marczewski: *Planification et croissance économique des démocraties populaires*, Vol. 2, Paris, 1956, p. 538.

[14] *ibid.*, pp. 538–539.

Given the rapid pace of change in the socialist countries (and in all the so-called 'underdeveloped countries') our attention must be focused less on actual production levels or present patterns of economic activity (important though these are) than on the emerging patterns and directions of development as expressed in the national plans of each country. We can understand or interpret these only if we have an awareness of the concepts of planning and the objectives of development in socialist societies—in other words, if we have some familiarity with what Clark has termed 'the furniture of men's minds'.

China, which has had a planned socialist economy for just over a decade, and the Soviet Union, which has been shaped by over four decades of such development, illustrate on a massive scale the way in which ideology can shape landscape.

China: From Cressey to the C.C.P.

China in 1949 exhibited almost all the by now classical symptoms of an underdeveloped country—a stagnating and overcrowded countryside, a small industrial sector concentrated in the Treaty Ports, inadequate communications, inadequate power supplies, almost non-existent social services, and a population largely illiterate, famished or diseased, and fated to die young. Life in China was 'nasty, brutish and short'. Yet the country had all the essentials for a rich and diversified economy: a wide range of metallic minerals, including some of the biggest iron-ore deposits in the world; immensely rich coal reserves; sizeable oil deposits; water power; and a huge potential labour force. The Chinese peasant could, indeed, be likened to a beggar sitting on a vein of gold-bearing quartz, unaware of the wealth within his grasp, or incapable, because of poverty and lack of technological 'know-how', of realising that wealth.

The Liberation of 1949 drastically altered the scene and initiated a transformation of the economy and of the landscape on a scale only dimly appreciated by most English and American geographers. Rapid industrialisation, with an emphasis on heavy industry; agricultural development within a new institutional framework; expansion of communications, education and all the other aspects of what the French term the 'infrastructure' of an economy—these have resulted in a new geography of China. That such a transformation was possible, and that such a *pace* of transformation was possible was doubted by Western experts. Cressey, for example expressed the view that 'any large program of economic development will require outside aid and extensive government credits if it is to proceed rapidly. China can lift herself by her own efforts if necessary, but it would take too long.'[15] Rostow's estimate[16] that the Chinese economy would grow 'quite rapidly, *i.e.* at an average rate of about three percent a year over the decade [1952-1962]' was equally unrealistic. Such errors of interpretation, and the possibility of equally serious errors in the opposite direction—of overestimating the Chinese achievement—arise because the English-speaking geographer tends to evaluate the various situations confronting him in terms of his own experience, which is experience within a particular and rather specialised socio-economic system—the 'free-enterprise system' of the West. They drive home the point that, if an understanding of geomorphology and climatology must rest on a certain competence in geology and physics, so, too, must any understanding of human geography rest on an acquaintanceship with economics and sociology. And if the societies we are concerned with are socialist in character the socio-economic orientation we need is a Marxist one.

'WALKING ON TWO LEGS'

In China the pace and pattern of development during the past decade is to be understood in terms of the 'general line' formulated by Mao Tse-tung and the Communist Party, and based on Marxist-Leninist theory, on the experience of the U.S.S.R. and other socialist countries, and on Chinese experience. As Liu Shao-chi explains it, the aim of the 'general line' is to 'utilise to the maximum the enormous potentiality of the socialist system for developing the productive forces of society, to mobilise all the positive factors, to unite with all the forces that can be united with, to put into effect the series of policies of "walking on two legs", to develop our national economy in a planned and proportionate way and at a high speed so that our country can change at a comparatively fast rate from a backward into an advanced country.'[17] Such a policy is highly flexible so that Chinese planners have avoided some of the errors of Soviet planners; moreover, its effectiveness is enhanced by the existence of a core of cadres who transmit to the masses the Party's directives in a clear and precise form, explaining, breaking down old myths, and at the same time acting as channels of communication back from the villages to Peking. Contrasts in resource endowment—or climatic conditions—provide no explanation of the widening contrasts in the achievements of India and China in the last decade; rather does the explanation lie in the character of Chinese development planning and the greater efficiency of the Chinese party organisation in transforming vision into reality.

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[15] G. B. Cressey: *Land of the Five Hundred Million*, New York, 1955, p. 348.

[16] W. W. Rostow: *The Prospects for Communist China*, New York, 1954, p. 283.

[17] Liu Shao-chi: 'Speech at . . . at the Fortieth Anniversary of the Founding of the Communis Party of China, *Peking Review*, 7 July 1961, p. 8.

The extent of the transformation is indicated by a fivefold increase in the aggregate output of industry and agriculture between 1949 and 1959, by a twelvefold increase in the gross output value of industry, and by a decisive shift from an agrarian-based to an industrial-based society. (By 1959 industry accounted for 66.6 percent of the gross output value of agriculture and industry, as compared with 30.1 percent in 1949.) This industrialisation has been characterised by parallel development of large-scale modern industry run by the state, and small-scale local industry run by the commune or cooperative. This policy of 'walking on two legs' is an obvious adaptation to the demographic conditions of an 'overpopulated' and backward country, for the development of rural industry helps to solve the chronic problem of underemployment, makes possible the maximum diffusion of new techniques through the countryside, and helps to overcome the deficiencies of the transport network. It results in a new and distinctive type of landscape, with a wide diffusion of small industrial units deep into the countryside; by 1959 these were contributing one tenth of China's total industrial production.

Expansion towards the Interior

Expansion has been accompanied by a decisive and deliberate shift of industry towards the interior and the minority regions. In 1952 almost three-quarters of China's industrial output came from the coastal provinces, but of the 'above norm' projects built under the First Five Year Plan two-thirds were located in the interior districts. In 1949 these interior districts had contributed less than a quarter of the country's industrial output; by 1958 this had risen to one third (of a greatly expanded output) and the rise of new industrial complexes such as Paotow, Lanchow and Urumchi-Karamai will accentuate this trend. This transformation reaches deep into the remote and backward minority regions; these have doubled their grain output and increased their industrial output tenfold in less than a decade. The effective integration of these regions into the national economy is illustrated by the expansion of their road network. While the country as a whole shows a fivefold increase in road mileage since 1949, they show an eightfold increase and today contain one quarter of China's road mileage.

The transformation of the agricultural scene is equally striking. The Chinese have set themselves the objective of 'thoroughly changing the face of China's countryside' and of 'constructing a new socialist countryside'. Massive investments of labour within the framework of the commune have greatly expanded the irrigated area, strengthened man's control over flooding and other calamities, laid the basis of a widely dispersed rural industry, and are creating new patterns of settlement. These changes follow the general lines laid down in the various agricultural plans and in Party directives; they provide a dramatic illustration of the importance of ideological factors in the shaping of the cultural landscape. At the same time, the policies followed are by no means inflexible; practical experience or theoretical discussion may, as was the case with the peasant iron industry, lead to drastic shifts in policy. We have, then, to bear in mind not only that ideological beliefs are shaping the landscape but also that, all the time, the practical problems which arise lead to a continuous reassessment of the policies which transform ideology into practice; that as men transform nature, their own way of thinking is transformed too. This complex interrelation between ideology and practice, this ceaseless rethinking of Marxist ideas in the light of Chinese needs and Chinese experience[18] provides one of the most challenging fields of study for the geographer concerned with contemporary China.

U.S.S.R.: FORWARD FROM THE TWENTY-FIRST CONGRESS

If China illustrates some aspects of the emergence of a planned socialist economy it is the Soviet Union that illustrates most strikingly the deliberate creation of a new social and economic landscape through careful and comprehensive state planning. This planning is focused on the attainment of clearly-stated objectives: the achievement, by 1970, of 'first place in the world both for absolute output of products and for output per head of population, which will provide the highest standard of living in the world'. For a state which, within the lifetime

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[18] Compare the situation in Cuba—S. Landau: 'Cuba: The Present Reality', *New Left Review*, London, May-June 1961, pp. 12-14.

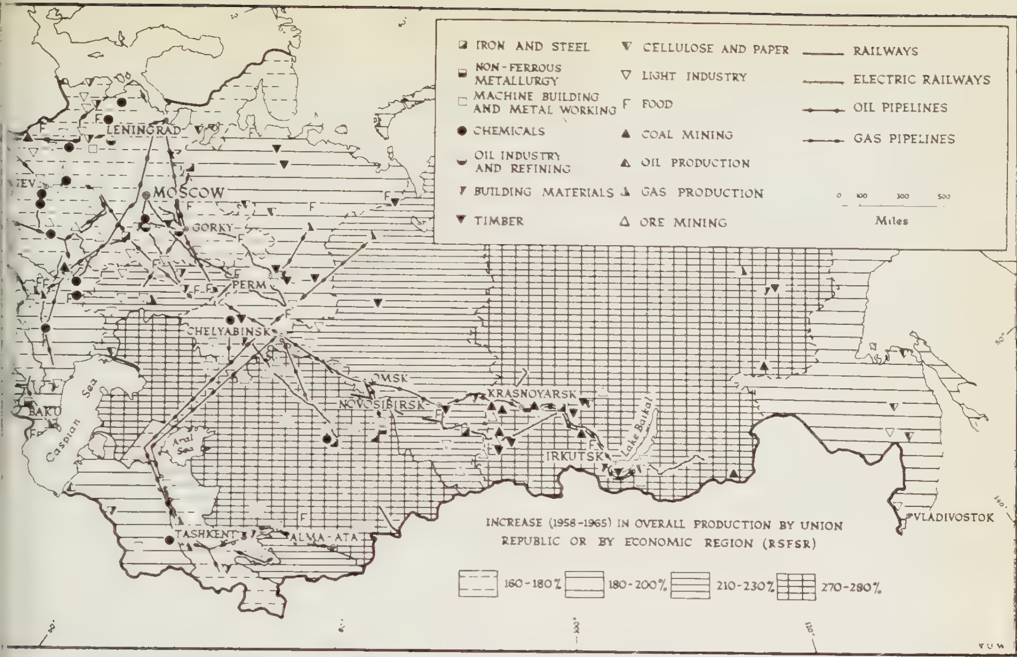

Fig. 2. New developments in the Soviet Union under the Seven Year Plan, 1958-1965. The map shows only *new* constructions under the plan and does not include existing plant or facilities expanded during the period of the plan. (Source: *Principal Constructions under the Seven Year Plan*, Department of Geodesy and Cartography, Ministry of Internal Affairs, Moscow, 1959)

of some of us, was a backward peasant country this is an ambitious target; it is to be achieved 'on the basis of Marxist-Leninist ideas' (*Fig.* 2).

The First Seven Year Plan (1959-1965), which initiates this advance, is the seventh in the series of plans which have shaped the economy and the geography of the U.S.S.R. since 1928. From the geographer's point of view it is perhaps the most significant of the plans, not merely because of the ambitiousness of its targets, but also because of the far-reaching changes in Soviet production patterns which it is initiating. Here I may quote from the *Economic Survey of Europe* published by the United Nations: 'The Soviet production profile is to alter . . . in five main respects. First, oil and gas are more rapidly to replace coal in the energy balance. Secondly, a modern chemicals industry is to be created to supplement and—to some extent—supplant traditional materials: plastics for timber and metal, man-made yarns for natural fibres . . . etc. Thirdly, engineering will be modified not only in its product-mix (with emphasis on electrical engineering and instrument making, principally to support automation, and on consumers' durable goods to support the housing drive) but also institutionally (with much more specialisation and exchange of semifabricates and components between factories). Fourthly, the building industry as a whole will use more prefabricated components. . . . Finally, the natural resources of the eastern regions are to be more intensively exploited, the Plan resuming the impetus of the First Five Year Plan but in new locations: [it] looks particularly to ferrous and non-ferrous metallurgy in East Siberia and Kazakhstan and to a consolidation of the recent expansion in the eastern grain fields.'[19] The plan, in its drive to raise the living standards of the Soviet people and to overtake the most advanced capitalist countries, is thus remoulding the geography of the U.S.S.R. Our interpretation of Soviet geography in the 'sixties must be in terms of the stated objectives of the plan; pure description will have little place in such an interpretation, rather must we understand the targets of development for the union as a whole, for each republic and each oblast and the various problems which will be encountered in the attempts to reach these targets.

Eastward Shift

Thus, the plan provides for a ninety-percent increase in productive investment which is expected to yield only a 62-65 percent increase in net material production. Partly this is because the plan is set in a perspective of fifteen years or so and some of the projects will be launched in the later years of the plan, to mature after 1965; partly this is because the eastward shift (prompted by both the resource endowment of the eastern regions and the Leninist concept of 'levelling-up' between advanced and backward regions) will involve the state in high capital costs in providing the infrastructure for new communities created by immigration or the high growth rates of existing eastern populations. Thus, this eastward shift and development of new resources may, over the shorter period, slow up the expansion of the total Soviet economy and retard the attainment of parity of living standards with the western world. These problems, the 'pull' of older economic centres where a given input of capital might be expected to give a greater material output, the conflict of this with a policy of dispersion which gives more immediate social and political returns, the changes in population distribution and composition resulting from such a policy—these are surely the very stuff of geography. But to analyse, assess and understand them we must be prepared to strengthen our competence in the fields of the social and political sciences, we must see the problems as aspects of the translation of a vision, and a statistically-expressed vision, into reality, and we must recognise that this vision is rather different from the Western vision of the Good Life. New problems call for new techniques, new viewpoints and a new and informed understanding of non-Western societies—which means the majority of human societies.

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[19] *Economic Survey of Europe in 1959*, Geneva, 1960.

'The Quincunx of Heaven runs low . . .'

My discussion of the ways in which ideology shapes landscape could obviously be greatly expanded. I could draw on the example of Czechoslovakia to illustrate in more detail the process of 'levelling-up' which is transforming the social and economic geography of the formerly backward Slovak lands. I could take a wider view and discuss COMECON, the Communist Council for Mutual Economic Aid, which is moving towards integrated planning of the Socialist bloc as a whole.[20] To discuss the emerging patterns of industrial specialisation in the Peoples Democracies without reference to this supranational planning council is to give but a travesty of reality. I could move from the socialist countries to the 'free world' and show how patterns of population distribution and industry in the South African Republic are being shaped by the racialist ideology of the Afrikaner; how political factors are shaping the land reform of the Italian South or the economic development of the West German countryside; or how the Zionist dream has become reality in the landscape of the new Israel. In each case my analysis would confirm the phenomenon referred to by Maurice le Lannou as 'the absolute geographical primacy of the state'. If I emphasise the socialist countries it is because here the political ideology is most explicit, the paths and goals of development most clearly stated, the progress most challenging.

This challenge is not merely a political, military or economic challenge. It is also a challenge to us as geographers. It is a challenge to us to widen our vision, to realise that there is emerging a new world which our traditional techniques are little fitted to analyse, to accept the increasingly obvious fact that if our discipline is to survive we must acquire new skills—and we must acquire them from such peripheral fields as development economics, sociology, political science and the like. It is a sad reflection on our subject that some who have attempted to integrate these new skills into geography should have been, should indeed still be, suspect, and regarded as heretics seeking to destroy the seamless unity of true geography.

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[20] An outline is given in G. Mirsky and L. Stepanov: *Asia and Africa, A New Era*, Moscow, 1960, pp. 82-87.

In the contemporary geography of the English-speaking world I see little to suggest we are willing to accept this challenge, that we are even aware of it. I see instead a 'folding-in' on the traditional fields, a monotonous churning out of sterile and outmoded descriptive studies, a sedulous avoidance of the geography—the controversial and challenging geography—of the non-Western three-quarters of the world, an increasing preoccupation with the refinement of techniques long shown to be inadequate or outdated. Indeed, I sometimes think we are in danger of paralleling the development of Old China where 'the very genius for political uniformity with no quickening impulses from outside and no breaks in history from internal revolutions, tended to freeze social forms . . . China developed a kind of paralytic immortal civilisation in which little was learned and nothing forgotten . . .' .[21] All I can hope, and it is but a slender hope, is that, as in China, a combination of inside pressures and outside influences will shatter our tradition-bound immobility, force us to a reappraisal of the resources, the content, of our discipline and drive home to us the need for acquiring new techniques and a wider viewpoint. That such a reformulation of our discipline is possible is shown clearly by the work of French and certain German geographers; that such a reformulation is needed is demonstrated by our increasing inability to understand, or to put over to our students, the realities of the new worlds emerging in that Eurasian continent which is our nearest neighbour.

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[21] J. Belden: *China shakes the World*, London, 1952, pp. 135-136.

MAN *IN* NATURE IN NEW ZEALAND

KENNETH B. CUMBERLAND

THE STIMULATING and imaginative suggestion has been made that the first domestication of plants and animals took place in Southeast Asia; that the earliest plant selection was by vegetative reproduction rather than by seeding and that the earliest domestic animals—dog, pig and fowl—were household rather than herd animals. Amongst the most ancient complex of plant domesticates were Himalayan and Malayan bananas, a taro of Indian origin and yams from Bengal to Indochina, sago, pandanus, bamboos and sugar cane, the leguminous derris and *Cordyline* spp. The first planters were sedentary fisherfolk; and amongst the first plants from which they selected clones were not only foodstuffs but sources of fish poison, colouring and fibre for matting, cordage, nets and line.[1] If this thesis is substantiated, then the peopling of the islands of the Pacific may have to be set back in time further than tradition and folklore would allow, and further than science has yet been persuaded to go.

The Pacific was colonised first from Asia. It was stocked by what is apparently a very ancient complex of domesticated plants and household animals. The dispersion presumably took place before the economy and culture of Asia's early planters were modified by a shift from selection by clones to selection by seed. This would appear to follow from the fact that, on the advent of Europeans, the islands of the Pacific preserved techniques of fishing and planting and patterns of plant and animal domesticates almost exactly as they are described by Sauer for the first hearth and cradle of domestication in Southeast Asia. Moreover, in the oceanic isolation of the Pacific there are preserved plants of Asian origin which have subsequently been largely lost to cultivation in the hearth of their domestication. Amongst those which have continued to be planted by man in the Pacific, or have survived ferally, are primitive bananas, inferior species of yams and rare horticultural varieties of pandans.[2] *Saccharum edule*, *Hibiscus* spp.,

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[1] Carl O. Sauer: *Agricultural Origins and Dispersals*, New York, 1952.

[2] Sauer: *op. cit.*, pp. 32-33.

Tacca leontopetaloides, *Pueraria* spp. and *Cordyline* spp. may also be ancient cultigens associated with the earliest form of vegetative selection.

THE PEOPLING OF THE PACIFIC

But whatever the date of the first penetration of the Pacific by men who commanded the use of fire and the ability to cultivate and carry with them useful plants, it is very late in the painfully slow and snail-pace continuum of the evolution and dispersion of man since hominisation occurred in the tropical Old World before the close of the Pliocene. Man has in any case been a part of the insular environment of the Pacific for only a minute fraction of human time, and has occupied the Pacific in such thin and scattered numbers as to represent at best an exiguous fragment of human numbers.

Yet the role of man in changing the face of nature in the Pacific has left its mark in many ways and many places. When this imprint is deciphered it is often of much more pronounced character than is widely appreciated. The capacity of man to alter the natural environment and to disturb the functioning of organic and biological processes, even in the restricted land area of the insular Pacific, has varied both with the diversity of the undisturbed natural conditions and processes that men have encountered, and with the succession of cultural attitudes and conduct and of technological paraphernalia which different human groups have brought along with them. Although cultural disturbance is historically cumulative, it is a mistake—one that has frequently been made—to underrate the effect which the earliest human groups have had in inhibiting and deflecting physical and biological processes, or in first setting such processes in motion. Because this ancient disturbance is remote in time, and difficult to reconstruct, and because the evidence for it is often confused and obscure, care must be taken not to overlook or depreciate its significance.

MAN COMES LATE TO NEW ZEALAND

Despite its size, in comparison with other Pacific island territories at least, man came last to New Zealand. Yet his arrival here was earlier than has until recently been suspected. Human occupance of these remote islands and the first cultural disturbance of the natural landscapes and biota are relatively so recent that their course can be better traced than in most other parts of the Pacific. Moreover the successive cultures can be sharply differentiated from each other and characterised with some assurance, so that the major contributions of each to the cumulative change can be more readily distinguished. There are still formidable gaps, however, in our understanding of the terrestrial and organic changes that man has originated, or which have followed in his train, and also in our knowledge of the dates and duration of the distinctive forms of cultural occupance. The New Zealand habitat embraced an unsuspected variety of climates, a range of flora to which the terms 'tropical' *and* 'subantarctic' are not improperly applied, and a little-known but extensive avifauna. Because of this diversity and because of the relative recency of the cultural disruption of the organic life of New Zealand, the story is of great interest and may be of value and significance in the unravelling of the temporally more remote incursion of man into the Melanesian, the Micronesian and the tropical parts of the Polynesian Pacific.

The first human group of which we have evidence, its material culture, economy and *genre de vie* were firmly established in New Zealand, and particularly in the South Island, by the end of the first millenium A.D.[3] The handful of accidental voyagers[4] who pioneered this venture and first trod the virgin land—presumably in the North Island—may have struggled thankfully ashore three or four hundred years before. Their material culture was clearly related to that of eastern Polynesia of the time. It has been suggested that it be designated the 'archaic phase of New Zealand eastern Polynesian culture' to distinguish it from the subsequent 'classic Maori phase of New Zealand eastern Polynesian culture'.[5]

THE NATURE OF THE VIRGIN LAND

In the last three centuries of the millenium, or until it was initially disturbed by man, New Zealand was essentially a forested land. From coast to treeline a dense forest, largely endemic, consisting of mixed podocarp-dicotyledonous (subtropical) or *Nothofagus* (subantarctic) species thickly and continuously mantled plains, hill country and mountain slopes alike, even in the driest parts of the country. There were minor exceptions which included coastal and inland swamps, sand dunes and shingle riverbeds. The only major exceptions were in the North Island. Here much of the eastern interior had been repeatedly showered, to within 500 years of this time, by a succession of intermittent Taupo pumice ash layers.[6] The Kaharoa volcanic ash shower, on the other hand, may even have been contemporary with early Polynesian settlement.[7] It affected mainly the Bay of Plenty; but it destroyed vegetation and extended sterile desert conditions from Te Whaiti to the Mamakus. Widely throughout the northern peninsulas the maturing of podsol soils under humid subtropical climates, and the acid litter of kauri forest, had led to waterlogging and forest decay. In all these districts the vegetation cover was of a lighter and more diversified nature with mainly shrubland species (especially of bracken fern and manuka) but with some less extensive gramineous associations.

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[3] According to Roger Duff: *The Moahunter Period of Maori Culture*, Wellington, 1956, p. 280, the 'accepted date of first moahunter occupation is 950 A.D.' Radiocarbon dating of material from the Wairau site suggests the culture was fully established there by from 905 A.D. to 1125 A.D. Camp sites were also fully established by 1140 A.D. at Pounawea, by 1190 A.D. at Papatowai and by 1210 A.D. at Hinahina in Otago and Southland (Leslie Lockerbie: 'From Moahunter to Classic Maori in Southern New Zealand' in J. D. Freeman and W. R. Geddes: *Anthropology in the South Seas*, New Plymouth, 1959, pp. 75-110).

[4] Assuming that Sharp's theory holds true at least for most pre-Fleet arrivals in New Zealand (Andrew Sharp: *Ancient Voyagers in the Pacific*, Wellington, 1956).

[5] See J. Golson: 'Culture Charges in Prehistoric New Zealand' in Freeman and Geddes, *op. cit.*, pp. 29-74.

Except on these recent materials and others of alluvial or marine origin, soils were developing almost everywhere under processes related to and dependent upon humid or superhumid climates and forest vegetation. Although some have argued strongly that the climate was until the thirteenth or fourteenth centuries A.D. variously warmer and wetter than it has been since,[8] there are strong grounds for insisting that the climate (as distinct from local microclimates and intra-vegetational and soil climates) was, throughout the period of moa-hunter occupance, not significantly different from that of the present century.[9]

The most distinctive and remarkable element in the natural environment of immediately prehuman New Zealand was its avifauna. Not only does it now appear that the first men encountered the entire range of moa genera in both islands,[10] but it seems that they also found a whole faunule of now-extinct birds, including swan, eagle, goose, rail and crow, together with a rich avifauna which has survived to the present time. Many of these birds were flightless and were grazing and browsing animals. They preferred more open country to the dark, dripping interior of the forest and, judging by the evidence of the extent of the population of some species, they must have exerted a persistent and conspicuous effect on vegetation, particularly on the scrub and forest margins.[11]

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[6] According to I. L. Baumgart: 'Some Ash Showers of the Central North Island', *N.Z. Journ. Sci. & Tech.*, Vol. 35, No. 6, May 1954, pp. 456-467, the Taupo eruptions continued at least until 250 A.D.

[7] The Kaharoa shower occurred after 650 A.D. and possibly as late as 1074 A.D. to 1214 A.D. (See G. J. Ferguson and T. A. Rafter: 'New Zealand 14C Age Measurements', *N.Z. Journ. Geol. & Geophys.*, Vol. 2, No. 1, February 1959, p. 223, and *idem*, 'New Zealand C14 Age Measurements, II, *N.Z. Journ. Sci. & Tech.*, Vol. 36, No. 4B, January 1955, pp. 371-374.) There is also evidence that the latest eruption of Rangitoto disturbed 'moahunter' settlement. (See R. B. Brothers and J. Golson: 'Geological and Archaeological Interpretation of a Section in Rangitoto Ash on Motutapu Island, Auckland', *N.Z. Journ. Geol. & Geophys.*, Vol. 2, No. 3, August 1959, pp. 569-577.)

[8] See especially John T. Holloway: 'Forests and Climates in the South Island of New Zealand', *Trans. Royal Soc. N.Z.*, Vol. 82, pt. 2, September 1954, pp. 329-410 and J. D. Raeside: 'Some Post-Glacial Climatic Changes in Canterbury and their Effect on Soil Formation', *Trans. Royal Soc. N.Z.*, Vol. 77, pt. 1, April 1948, pp. 153-171.

[9] Kenneth B. Cumberland: 'Climatic Change or Cultural Interference?—New Zealand in Moahunter Times' in a volume of essays dedicated to George Jobberns (N.Z. Geographical Society Special Publication, in the press).

Moa, Moahunter and Fire

There is no evidence that New Zealand's earliest human pioneers brought domesticated plants from their tropical island homeland. Even if plant material did survive the fortuitous canoe voyages and the toll taken by hungry passengers—men, dogs and rats—it is unlikely that first plantings would yield a harvest in unaccustomed soils and climate. It appears probable that the settlers survived as fisherfolk and explored the new land by coastal voyages, shunning the cool and dripping bush, the sparse shrubland, and the bare sterile ash of the North Island interior.

In the south, however, they found drier, though frostier, littoral sites for settlement with patches of grassland reaching inland and frequented in large numbers and great variety by the moa. Moreover there was a rich avifauna on coastal lagoons and more varied marine resources than in the north. Here they mainly camped and settled, and occupied coastal sites for upwards of 500 years. Here they organised an economy based pivotally on the moa which became a source of food, raw materials, clothing, water vessels and ornaments. A traditional, but long-forgotten, Maori name for the moa is *kuranui*, which may be translated as 'great treasure' or 'principal resource'.[12]

There is now little doubt that the culture, economy and way of life of the moahunters depended significantly on the use of fire. What, however, is not adequately appreciated, is the extent of the disturbance of the ecosystem in New Zealand wrought from the dawn of human settlement by fires, purposely and accidentally ignited by man. The evidence has recently been brought together in another publication.[13] It consists principally of the radiocarbon dating of logs which are remnants of ancient South Island forests and which occur, with few exceptions, throughout the historic tussock grasslands. These forests were largely destroyed by fire some time before the fashionable dates (1200 A.D.–1350 A.D.) of the alleged change of climate which has hitherto been thought to explain the former anomalous occurrence of forest vegetation and soils.

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[10] It was previously believed that the moahunter probably encountered only *Euryapteryx gravis* and possibly *Emeus crassus*. However archaeological evidence (both from the North Island and from Southland) and the C14 dating of peat swamp remains of moa suggest that all genera and species persisted into human times, including the giant *Dinornis* and that they were hunted and eaten.

[11] *Dinornis* 'probably required as much grass a day as a bullock' (Roger Duff: 'Moas and Moahunters', [N.Z.] *Post-Primary School Bull.*, Vol. 5, No. 7, July 1957, p. 132). Moa remains with a density of 800 per acre have been recovered from Pyramid Valley swamp, North Canterbury and 800 skeletons were found in an area 30 feet by 20 feet at Kapua, Waimate, South Canterbury.

[12] It may also be of significance that an early name for the South Island derived from later tribes of moahunter stock is given as 'food-abounding island' (J. W. Stack: 'Traditional History of the South Island Maoris', *Trans. N.Z. Inst.*, Vol. 10, Pt. 1, 1879, p. 64).

Whether the fires were lit in part as an aid to hunting the moa, and whether they were in a measure responsible for the extermination of a unique and diversified avifauna within considerably less than a thousand years, is a matter of speculation. But, in any event, not less than eight million acres[14] of forest had been replaced by grass and scrub and many more acres had been disturbed and diversified; soil forming processes had been widely reversed and polymorphic profiles induced; the moa, eagle, crow, species of duck, rail, goose and swan (of which there is evidence in moahunter settlement sites) had become extinct; and the typical culture and economy of the moahunters had been superseded and their settlements abandoned by the beginning of the seventeenth century. That at most thirty generations and a population probably never amounting to more than 25,000 persons were in fact largely responsible for this massive disturbance and modification of the habitat is increasingly evident. Thus even primitive man, without domesticated plants and animals (the dog alone excepted in this particular case), has been a powerful agent in transforming the face of the earth.

It is possible that, before agriculture was introduced to the earlier-occupied and scattered islands of the tropical Pacific, man, using fire as his principal tool, lived by hunting and gathering. It seems likely that, despite the heavier rainfall of the largest high islands of the lower latitudes, the tropical grasslands there might not only be culturally-induced but might also be more ancient features than is generally

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[13] Cumberland: *op. cit.*

[14] Calculated by planimetric measurement from maps in Cumberland *op. cit.* based largely on the work of J. A. Johnston: *Recent Climatic Change in South Island, New Zealand,* Unpublished M.A. thesis, Univ. of N.Z., Christchurch, 1958.

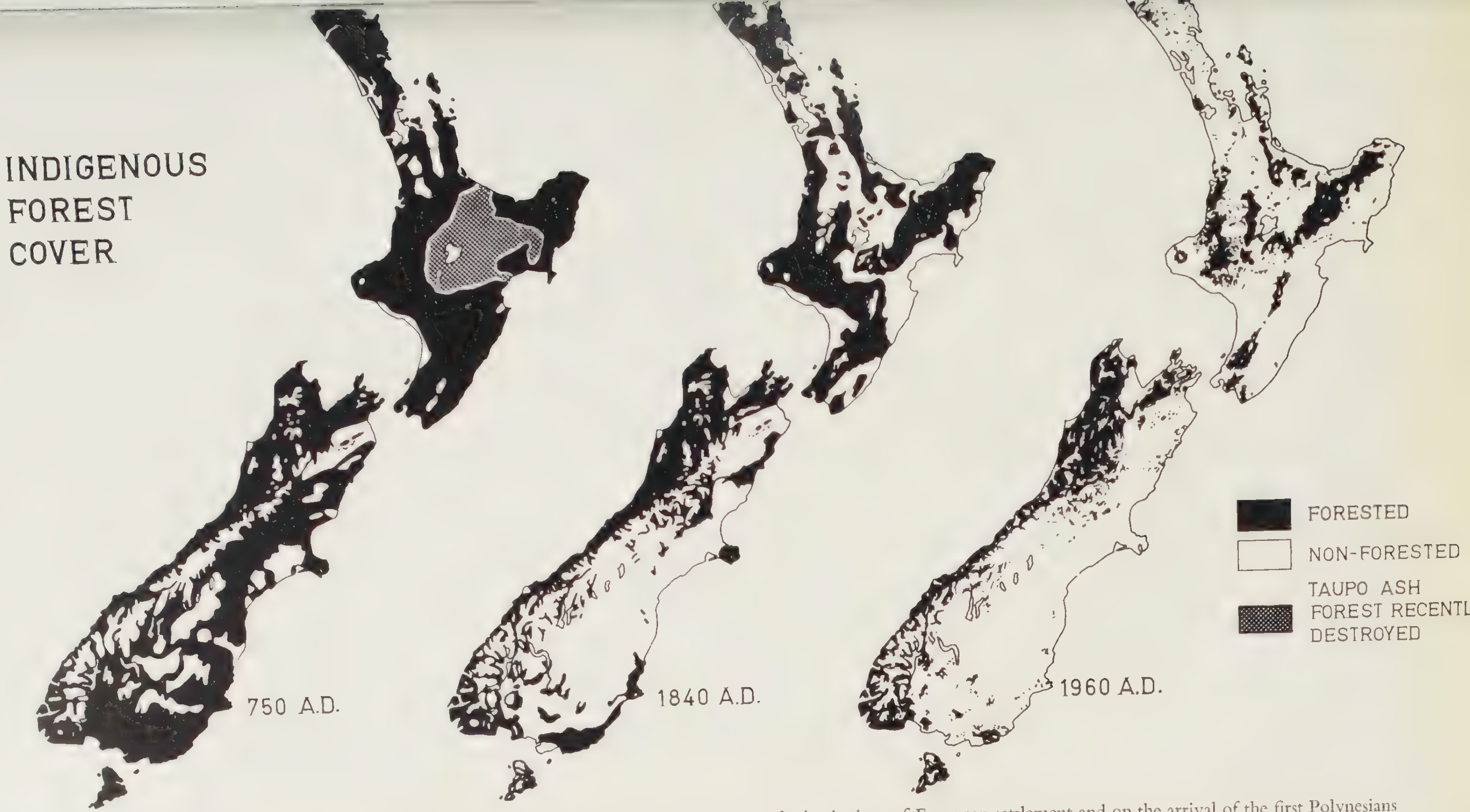

Fig. 1. The present-day indigenous forest of New Zealand, and its probable extent at the beginnings of European settlement and on the arrival of the first Polynesians thought, and may indeed, in some cases, precede the use of fire in land-rotating plant agriculture.[15]

The Maori brings Domesticated Plants

The development of the way of life and the economy of the classic Maori culture in New Zealand, however, has rather closer and much clearer affinities and parallels with the course of the cultural disturbance of the island habitats in the tropical Pacific during European and immediately pre-European times.

The 'Fleet' Maori, tradition would have it, reached New Zealand in 1350 A.D. No matter how or when this principal Polynesian immigrant wave[16] reached the mid-latitude New Zealand island, its culture and associated pattern of resource utilisation was established widely in the North Island by the fifteenth century.[17]

In 1350 A.D. the North Island was still a forested land, probably more completely covered in forest than on the advent of the Archean Eastern Polynesian culture 600(?) years before. In the interim, vegetation had occupied the pumice surface of the interior, and former shrubland or recent volcanic ash had widely given way to mature forest stands

The Maori brought with him cultivated plants and, more remarkably, succeeded in establishing several domesticates in the harsher climates and leached acid soils of New Zealand. These included *Ipomoea batatus*, *Colocasia*, *Lagenaria vulgaris*, *Dioscorea* sp., *Cordyline terminalis* and *Broussonetia papyrifera*. Despite the skill he exhibited in making further selections more suitable to the soils and climate of the new environment from the plant material he had established, and despite the *tapu*-controlled techniques of cultivation he so carefully employed, gardening rarely, if at all, became his principal means of subsistence. It figured prominently in his economy only in the northern peninsulas and in littoral tribal districts south to Taranaki and Poverty Bay.[18]

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[15] In his recent review of subsistence economies in the Pacific, Barrau envisages the early necessity there of foraging in the economy of earliest human times, and allows of the employment of fire not only in shifting agriculture but also for hunting purposes. (See Jacques Barrau: *Subsistence Agriculture in Melanesia*, Noumea, 1955, p. 27 and *idem*: *Polynesian and Micronesian Subsistence Agriculture*, Noumea, 1956, p. 18.)

[16] In view of the arrival and settlement in New Zealand of considerable numbers of Rarotongans, Niueans, Tongans and Samoans in the last twenty years, it would be innaccurate any longer to speak of the arrival of the Maori fleet as the largest or most recent Polynesian immigrant wave.

[17] The temporal distinction between moahunter (Archaic) and Maori (Classic) cultures, distribution and period of occupance is not clear. The former may have persisted for some centuries side by side with the latter both in the North Island and in the South. (See Brothers and Golson, *loc. cit.*, and Lockerbie: *op. cit.*) Cultivation may have been introduced and become localised in the North Island long before the Fleet traditions suggest, but may have made little impression on the South Island because of the firm establishment there of a fishing and bird-hunting economy as well as because of climatic difficulties.

The Maori and Vegetation

The Maori is generally considered to have been a conservationist and not to have unnecessarily disturbed the landscape and habitat. By contrast with his Polynesian predecessors and European successors he was indeed much less of a disturbing agent. He cleared the forest to establish his *pa* and *kainga*; he modified the contour of the land by terracing sites for hill forts; he diverted streams and probably excavated estuarine canals to aid his catching of eels; he dug pits to secure sand and shingle to spread on heavy soils to improve and speed the growth of *kumara*; but he nowhere wrought a wholesale transformation of his environment or a disastrous disturbance of the landscape.

There is, however, increasing evidence and opinion that the Maori had a greater role in changing the face of the land than has hitherto been apparent; and the evidence suggests that fire was his most important weapon.[19] The extent of the pre-European population is not known. It may have been 200,000, or several times that number. It is clear, however, that more than ninety percent of it lived in the North Island and that the highest densities, often greater than rural densities of population today, were to be found in the northern half of the North Island.

The North Island was humid and heavily forested except only where coastal sand and alluvial swamps and pumice scrub disrupted the continuity of damp, aggressive forest growth. To cultivate his crops, clearings (*waerenga*) had to be made in the forest. This was done by firing. The process was found to be much more difficult than in the moahunter's experience on the critical drier margin of forest growth in the South Island. Fires rarely carried and usually required prior slashing of branches and undergrowth. And in any case the bush was capable of regenerating rapidly on abandoned gardens (*mara*). The cumulative effect of this patch burning by generations of Maori gardeners, particularly in the most densely populated parts of the North Island, had a significant effect on the vegetation, extending the area of second-growth forest, diversifying the pattern and arrangement of species, and replacing forest by scrub and fern.

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[18] Elsdon Best: *Maori Agriculture*, Wellington, 1925, and Kenneth B. Cumberland: 'Aotearoa Maori: New Zealand in 1780', *Geog. Rev.*, Vol. 39, No. 3, July 1949, pp. 401-424.

[19] Although Best's standard work does not mention the term, Maori agriculture was essentially a form of shifting cultivation. Specifically it involved a lengthy fallow rotation of fire-cleared land. This is revealed by the accounts of the earliest observers before European tools, crops and techniques brought about significant changes. See especially W. Bayly: 'Bayly's Journal' in Robert McNab: *Historical Records of New Zealand*, Vol. 2, Wellington, 1914, pp. 200-221; R. A. Cruise: *Journal of a Ten Months' Residence in New Zealand*, London, 1823; Augustus Earle: *A Narrative of a Nine Months' Residence in New Zealand in 1827*, London, 1832; W. B. Marshall: *Narrative of Two Visits to New Zealand* [*in 1834*], London, 1836; J. L. Nicholas: *Narrative of a Voyage to New Zealand performed in the Years 1814 and 1815*, 2 vols., London 1817. In addition a number of subsequent students (E. Dieffenbach, *Travels in New Zealand*, 2 vols., London, 1843, esp. Vol. 1, pp. 201, 207 and 227-228; W. Colenso: 'On the Vegetable Foods of the Ancient New Zealanders before Cook's Visit', *Trans. N.Z. Inst.*, Vol. 13, 1881, pp. 3-38; Archdeacon Walsh: 'On the Cultivation and Treatment of the Kumara', *Trans. N.Z. Inst.*, Vol. 35, 1903, pp. 12-24; and Rev. R. Taylor: *Te Ika a Maui*, London, 1870) emphasised the role of fire in the shifting agriculture of the Maori. Taylor in particular makes the position clear: 'Three years cropping being, in general, all that can be obtained from one spot, the place is then abandoned and another selected. But this abandonment is only for a space of time; . . . the soil. . . . is allowed to remain unoccupied until it is covered with a growth of wood, if situated in woodland; or of fern, if in fernland, which requires a period of from seven to fourteen years, when the spot is again cleared and planted. Thus many places which appear never to have been touched by the hand of man, are pointed out as having been the farms of some ancestor, and when more closely regarded, will be found destitute of timber.'

THE MAORI AND SOILS

But locally, possibly over some tens of thousands of acres, Maori agriculture was a permanent, or near permanent, rather than an occasional and shifting, activity. That this was possible was the result of an ingenuity and skill which the Maori evolved for the handling and treatment of New Zealand soils considerably in advance of those developed by his Polynesian contemporaries in the oceanic tropics. It involved an intensive and lasting ameliorative interference with physical and biological sections of the habitat. Zonal soils in New Zealand, developed from acid sediments under a humid climate and forest cover, were characteristically sticky and intractable clays. This was especially so in the A′B and B′B (superhumid and humid mesothermal) climates of northern areas where alone the infrequency of frost was conducive to the successful cultivation of the restricted range of introduced food crops. The primitive wooden tools available required friable, or permanently moist (swamp), soils. Consequently leached zonal soils were little used. Fortunately some intrazonal and azonal soils offered greater promise.

Red-brown loams and brown granular clays from basalt and andesite (as at Tamaki, Taiamai and elsewhere in the north) accommodated the major concentrations of cropped land. With such soils the Polynesian had wide experience. Some yellow-brown loams and yellow-brown pumice soils in the Waikato and Bay of Plenty proved attractive to the Maori gardener. Alluvial soils were also generally suitable except where subject to flooding and high water tables, although they were colder and retarded the crop, and were sometimes subject to more frost than adjacent slopes. In many cases the nutrient level of these tractable soils was regularly raised not only by burning wood and second growth *in situ* but probably also by transferring to these preferred tracts vegetable matter from adjacent hill-land and burning it by slow fires, thus adding soot, charred material and charcoal to the wood ash. This is a technique employed by oriental horticulturalists even today and similar to the *chitemene* system of shifting cultivation amongst Rhodesian tribes. It added to New Zealand soils a blackness and a high level of plant nutrients which has sometimes persisted to the present time.[20]

There is still more impelling evidence that the Maori purposefully altered the texture of the soils he used and in some cases actually created a new M[an] horizon on top of existing profiles. This he did by laboriously carting thousands of tons of sand and gravel in flax baskets to mix with or to bury existing topsoils. He did it in order to improve the tillage, drainage and heating properties of the soil. The operation was widely carried out from Nelson to the Waikato. In the valley of the middle Waikato no less than 5,000 acres have been treated in this way and have up to ten inches of black, fine, gravelly sand, with charcoal throughout, on top of an original yellow-brown loam derived from water-sorted pumice ash. Under such conditions the *kumara* was probably a regular annual crop, and cultivation was permanent until tribal warfare in the eighteenth century made permanent settlement and agriculture impossible.

Foraging

However, the principal staple vegetable food of the Maori was *aruhe*, the root of the fern *Pteridium esculentum*. What have been considered as 'agricultural' implements were sometimes tools principally, or even exclusively, used for digging or grubbing fern root. This plant is one of the most catholic and widespread in the indigenous flora, occurring in all soils and climates. It was a starchy staple in the diet of all tribes, especially of those occupying territory where cultivation was difficult or impossible with the crops and technology available to the Maori.[21] It may also have been the chief vegetable food of the moahunters. Bracken fern, as the European pastoralist was to discover, is a pyrophyte, its growth and spread encouraged by firing. The Maori kindled fire to extend its domain. He may even have planted selected varieties. To dig *aruhe*, men worked in line using the *ko* (digging stick) like a crowbar to loosen and lever clods of earth which were then broken up by wooden clubs and grubbers (*timo*).

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[20] N. H. Taylor: 'Soil Science and New Zealand Prehistory,' *N.Z. Science Review*, Vol. 16, Nos. 9–10, September–October 1958, p. 77.

[21] Even in the Bay of Islands, Crozet in 1772 found fern root 'the basis of the food of these people . . . . they also live on potatoes [*kumara*] and gourds, [but] I think it well to repeat here that fern root forms the basis of their food' (quoted by Best, *op. cit.*, p. 13).

This process of foraging must have extended over hundreds of thousands of acres. Recurrent firing of shrubland and digging of fern root were a most effective combination of devices in modifying vegetation and soils. Soil horizons were mixed and the ground frequently disturbed. Fern-root digging was indeed unplanned, but intensive, tillage, and it extended the cultural interference normally associated with shifting long-rotation agriculture far beyond the limits of formally tended *mara*.

Agent of Change

In a more subtle way than the moahunter, the Maori, like his contemporaries in the tropical islands of the Pacific, interfered significantly with the environment. As a fowler and fisherman he appears to have been by design a conservationist and not to have reduced the number and variety of the bird, marine and freshwater resources upon which he so largely relied. But as a gatherer and shifting agriculturalist he intervened disturbingly with plant life and soil. Around *pa* sites and *kainga* his excavations, terracing and tramping removed vegetation. His building of shell, bone, ash and midden refuse heaps enriched the soil. In the adjacent forest and scrub his clearing of ground for crops, digging of *aruhe*, and collecting fuel removed the original cover, whilst his preservation, selection and planting of indigenous species prized for food (*Corynocarpus laevigatus*, for example), bast, bark and fibre (*Phormium tenax*) created groves of trees and plots of other plants (*Cordyline* spp. among others) not apparent in nature. Fire reduced litter and leaf mould, and may have caused a shift from acid to neutral soils. Cultural interference gave aggressive weedy plants—whether free-seeding like manuka (*Leptospermum* spp.), or propagated by rhizomes like fern—an advantage, especially those tolerant of fire and of a variety of soil and climate. The Maori's disturbance of the natural environment extended the opportunity of the variant plant, facilitated hybridisation and increased the diversity of plant associations.

European Incursion

The incursion into New Zealand of the European is recent and its results are well-known, even if not perfectly understood. They have been the subject of much study.[22] The implications of the impact and resulting disturbance are, however, even yet not always clear. And the invasion continues with unremitting force.

Many features distinguish this most recent cultural disruption of the environment in New Zealand from those which preceded it. The numbers of men involved have been much larger and, apart from their high rates of natural increase, the immigrant invasion has persisted. They have control of inanimate energy and mechanical aids. Their culture has throughout also been one with high and constantly improving systems of communications. It has maintained contact directly and indirectly with all other progressive and dynamic cultures. Systems of communication and transportation have facilitated both intentional and accidental imports (and exports) of seed and other plant materials, of animals and insects, as well as of materials, manufactures and gadgets. This has also resulted in a free and continuous flow of ideas, stimulating native ingenuity, imagination and inventiveness. Thus, to paraphrase Julian Huxley, European man has in New Zealand done more in a hundred years to alter the biological aspect of the land than nature and man together accomplished in the previous five thousand years.

Wholesale Disturbance of Nature

The first Europeans turned their attention to marine and indigenous plant resources and quickly decimated seal and whale populations, extracted accessible timber for spars, and encouraged the planting and commercial exploitation of *Phormium*. Attention was next diverted to the open, moahunter-induced, grasslands of the South Island. As with moahunter and Maori, fire was also the principal weapon of the immigrant European pastoralists. Millions of acres of tussockland were burned, much of it annually for many years. But unlike his predecessors, the runholder had also the range of the world's domestic and wild animals at his call, and a host of alien plants accompanied him and his flocks into the fire-blackened tussocklands. Sheep, cattle, goats and pigs were introduced, the last three reverting in the early years of settlement to a feral state. Soon others brought deer, rabbits, moose, wapiti, chamois and tahr. Fire, grazing, browsing and fuel needs pushed back the edge of the remnant *Nothofagus* forest, and relict patches of matai forest in accessible areas all but disappeared.

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[22] See for example, G. M. Thomson: *The Naturalisation of Plants and Animals in New Zealand*, Cambridge, 1922; L. Cockayne: *The Vegetation of New Zealand*, Leipzig, 1928; H. Guthrie-Smith: *Tutira: A New Zealand Sheep Station*, Edinburgh and London, 1953; E. Bruce Levy: *Grasslands of New Zealand*, Wellington, 1955; K. B. Cumberland: *Soil Erosion in New Zealand: A Geographic Reconnaissance*, Wellington, 1947; *idem*: 'A Century's Change: From Natural to Cultural Vegetation in New Zealand', *Geog. Rev.*, Vol. 31, No. 4, October 1941, pp. 529-554; A. H. Clark: *The Invasion of New Zealand by People, Plants and Animals*, New Brunswick, 1950; and K. A. Wodzicki: *Introduced Mammals of New Zealand*, Wellington, 1950.

The next major assault was on the mixed 'subtropical' forest of the North Island. It came after the Maori wars and was speeded by developments in dairy technology and refrigerated transportation. It was again conducted by fire and livestock. It resulted in the almost complete transformation of the vegetation, and in a disastrous disturbance of North Island soils all within the span of a human lifetime. The introduction and refinement of the pastoralist's bush-burn technique of converting a dense and unique forest cover to swards of introduced high-yielding grasses and clovers resulted in a peak of forest destruction in the decade 1890–1900 which involved not less than nine million acres.

The effects on the soil of this aggressive wholesale disturbance of biota did not become apparent for some years. But in the 1930's and 1940's soil erosion, declining fertility, 'reversion', 'land deterioration' and weed invasion became formidable problems which halted and set back not only the expansion of agricultural production but the country's economy, and cost a great deal in time, labour and capital to remedy.

INTRODUCED PLANTS AND ANIMALS

Meanwhile the European has by design and accident assembled in New Zealand a very considerable proportion of the world's fauna and flora and created in the country strange, new and alien conditions in which part of the indigenous plant life ran riot and in which some more delicate species found survival difficult, if not impossible. From the four quarters of the earth came pasture species and the whole gamut of temperate and tropical domestic crops, fruit trees and ornamental plants, some to thrive better than in their original or earlier homes. Trees and shrubs for timber, shelter and ornament came from all the continents, some soon to be taken, even by the Maoris, as indigenes and others to be planted to make the world's 'largest exotic forests', and, though no substitute for the timber trees burned and destroyed, to become important cornerstones in the future prosperity of the nation.[23] With the useful plants came useless weeds; and whilst none of them has ranked with *Leptospermum* and *Pteridium* in the acreage of land occupied, some have been much more difficult to handle even in this age of complex and varied weedicides. The introduction, history and spread of the once-peaceful denizen of the Argentine pampas, *Nassella trichotoma*, and the peculiarly favourable ecological niche it found for itself in the disturbed ecosystem in New Zealand, is a particularly interesting and yet representative example of the accidental introduction of alien species.[24]

RABBIT, DEER AND OPOSSUM

Amongst introduced animal 'pests' there are examples which ecologically and economically have played as spectacular a role as any plant 'weed'. Perhaps the three most significant have been the rabbit (*Oryctolagus cuniculus*), the red deer (*Cervus elaphus*) and the Australia opossum (*Trichosurus vulpecula*). For many decades New Zealand may well have had a rabbit population of between fifty and a hundred million. Skins exported have at times amounted to more than twenty millions a year, and the many animals poisoned or fumigated have not figured in export statistics. On a conservative basis of ten rabbits to one ewe[25] their direct economic significance is apparent. But the economic cost of their selective and close grazing, of baring the soil to wind, frost and rain, and of fouling land by droppings cannot be calculated, although the ecological results have often been most apparent especially in the drier tussock grasslands and 'man-made desert' areas of the South Island.[26] For the deterioration of millions of acres they have been, together with burning and overstocking with sheep, a contributory cause.

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[23] Monterey pine (*Pinus radiata*) has in less than a century become the most widespread tree in the country and characteristic of all but a few areas, occurring in plantations, farm shelterbelts, open scrubland, city parks and on recently-cleared areas of native bush. It seeds and regenerates freely on almost all soils and grows rapidly into a tall, upright tree. It has become the raw material of large-scale integrated timber, pulp and paper industries. Treated radiata pine is now also New Zealand's principal constructional timber.

[24] See A. J. Healy: 'Nassella Tussock: Field Studies and their Agricultural Significance', *N.Z. Dept. Sci. & Ind. Res. Bull., No. 91*, Wellington 1945. In recent years it has become necessary to establish special regional local government authorities similar in purpose to existing Rabbit Boards to combat *Nassella* and its aggressive tendencies.

[25] Wodzicki: *op. cit.*, p. 125.

[26] Exports of rabbit skins in the decade 1939–1948 averaged 13.7 million. In 1958 they disappeared from the list of exports. The spectacular success of the decommercialisation of the 'industry' by the 'killer' policy of Rabbit Boards, which now almost blanket the country, was responsible for this change. Where *Myxomatosis cuniculi* proved quite ineffective, traditional methods—poisoned bait distributed from the air, cyanide fumigation, guns and traps—rigorously applied so that rabbit 'farming' was eliminated, have virtually removed the rabbit from the list of animal pests.

The damage of red deer and opossums on the other hand is principally in the forests. The deer also roam over the mountain tussock and subalpine vegetation of the South Island as well as through the *Nothofagus* watershed forests and exotic conifer plantations, whilst the opossum—fast increasing in numbers—is also an orchard, plantation and garden pest. It has now replaced the rabbit and hedgehog as the chief mammalian victim of highway traffic. Opossums even occur thickly in some urban residential suburbs. Deer have long been subject to control by permanent government-employed hunters, but their numbers appear stationary. Between 50,000 and 100,000 skins are exported annually. The average annual export of opossum skins approaches half a million.

LIVESTOCK

In New Zealand there are more domestic livestock in relation to population than in any other country, and more per acre of occupied land than in all but few other lands. In sheep equivalents they number almost 110 million, 1.7 per acre or 45 per capita—this in a land which less than two centuries ago knew no grazing or browsing animals. The ecological transformation necessary to allow of the establishment of these flocks and herds constitutes the real history of New Zealand in European times. It has been a continuous struggle, often tentative, always experimental, and sometimes fraught with real dangers to the land, the biota and man himself. The resultant soil erosion has at times caused the abandonment of hundreds of thousands of acres, and threatened the pastoralist's enforced retreat from even more. Today, however, the transformation reveals a greater degree of permanence, the livestock are firmly established and increasing in numbers, and methods have been devised which, given satisfactory economic conditions and the necessarily constant human care, give promise of a new ecological balance within the ecosystem. To describe this balance would require the writing of an agricultural geography and ecology of the dominion.

SOILS AND PASTURES

A conservative estimate suggests that in the century since 1860 the equivalent of over 3,000 million sheep[27] have trodden the surface, compressed the soil, grazed the vegetation, and contoured the land of New Zealand. This domestic livestock population has been supported overwhelmingly on introduced and indigenous pasture plants, only to a minor extent on cultivated fodder crops, and quite insignificantly (at least in the postpioneering phase of pastoral establishment) on wild, non-pasture species. The principal exotic grasses involved have been *Lolium* spp., *Agrostis tenuis*, *Festuca rubra*, var. *fallax*, *Dactylis glomerata*, *Cynosurus cristatus* and *Paspalum* spp. The most important indigenous grasses grazed have been *Danthonia pilosa* and *D. semiannularis*, and the tussock species (especially *Festuca novaezelandiae*). But the key to the successful establishment of permanent pastures and of continued intensive grazing, without deterioration of soil or swards, has been white clover (*Trifolium repens*) and, to a lesser extent and in special situations, *Lotus* spp., *Trifolium pratense* and *T. subterranean*.

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[27] This figure takes into account only sheep, cattle, pigs and horses, allowing sheep an average life of four years up to 1900 and three years thereafter, lambs (separately enumerated) one year, cattle four years and horses ten years. Of a total of sheep equivalents of 3,110 million, sheep and lambs account for 78 percent, cattle for 20 percent, horses for one percent, and pigs for one percent.

Grass growth hinges largely on available soil nitrogen. To encourage growth of legumes the generous application of phosphates and lime has become standard practice. In 1960, 300 aircraft made more than a million and a half flights to spread almost 600,000 tons of phosphatic fertilisers over nearly 4,250,000 acres out of a total area of pastureland topdressed of almost ten million acres. The legumes thus encouraged fix nitrogen from the air and transmit it to the soil, both directly from their roots and indirectly through animal excreta, in sufficient quantity to maintain, under judicious management, a cycle of high livestock productivity and of high residual return to the soil of plant foods in a most readily available form.

This cycle of fertility rests on skilled and careful human control. Two features are of special interest. The New Zealand economy is based emphatically on the export overseas of agricultural products. Excluding the weight of hides, skins and pelts, these amount to more than a million tons a year, a large part of which is mineral matter, especially calcium and phosphate. This is largely balanced by imports of phosphate rock from other Pacific island territories—Nauru and Ocean Island—totalling more than 600,000 tons a year.

CONCLUSION

It is almost a century since George Perkins Marsh drew attention to the Southwest Pacific as 'a theatre where man is engaged, on a great scale, in transforming the face of nature'. He considered Australia and New Zealand 'to have greater facilities and stronger motives for the careful study of the topic. . . . than have ever been found combined in any other theatre of European civilisation'.[28] Marsh would probably have been rather disappointed that the 'motives' for study and research have not been strong enough and that the 'facilities' have sometimes been disappointingly neglected. On the other hand, Marsh's motive was the taming of nature for economic and practical ends rather than its preservation in the wild state for aesthetic and sentimental purposes. In this he would largely approve of what has been accomplished in a brief century in New Zealand.

The potency of man in the tropical islands of the Pacific was, until the coming of the European, characterised not by a superiority of strength or numbers, but by what Jean Bruhnes has termed a 'synthesis of a series of small achievements'. To some extent this best describes the disturbance of the physical-biological habitat of the tropical island territories even since the eruption of Europe into the Pacific. In New Zealand the last century, however, has seen a profound disruption, economically motivated, deliberate and intended (if not carefully planned), and accomplished by advanced techniques ruthlessly applied. For a brief interval it appeared to some that disaster might follow the disruption. But there has emerged a situation in which the ecosystem is apparently not seriously unbalanced and in which man has learned to live with the nature which contains him. The Southwest Pacific richly illustrates the geographical variety and historical cumulation of human agency on earth. Some changes that man has wrought have been destructive, others constructive. Some have been planned, others have been fortuitous and accidental; of still other changes set in motion there is as yet no awareness and certainly little suspicion. Man cannot therefore be sure of his future; and his past provides only limited grounds for optimism especially in the light of his exploding numbers and his mounting wants.

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[28] George Perkins Marsh: *Man and Nature; or, Physical Geography as Modified by Human Action*. New York, 1864.

FARMING-TYPE REGIONS OF TASMANIA

PETER SCOTT

TASMANIA has long been renowned for the variety of its rural landscape. Its rugged terrain and local variations in soil and climate, which together restrict farming to less than two-fifths of the land surface, are prominent factors contributing to this rural diversity. But also important have been the generally smaller holdings than those that prevail in similar types of farming on the Australian mainland; the lower level of capital investment in farming; and, especially, the high freight costs incurred in shipping farm products to mainland and oversea markets. These disabilities have prompted many Tasmanian farmers to hedge against uncertainty by undertaking two or more enterprises that yield products subject to differential price movements. As a result, Tasmania exhibits a marked diversification both of enterprise within the farm firm and of farming within many areas.

This article seeks to summarise and discuss the salient features and relative importance of the principal farming-type regions of Tasmania. Types of farming have been determined by the enterprise structure of gross farm incomes, and the relative importance of farming-type regions by the gross value of regional farm income. Some reference is made to such concomitant aspects as crop yields, livestock densities, mechanisation, and rural population densities, but shortage of space restricts comment to a few outstanding features only. Similarly, pressure on space precludes description of the breed composition of the sheep and cattle population, which shows some marked local variations. However, consideration is given to farm size and agricultural marketing, both of which directly affect the economic regionalisation of farming.

DELIMITATION OF REGIONS

Types of farming were initially investigated by a questionnaire farm survey. A questionnaire seeking, *inter alia*, estimates of gross farm income derived from each enterprise in 1953-1954 was sent to 1,100 holdings, or ten percent of all rural holdings in Tasmania excluding the Bass Strait islands. The holdings were selected by random sampling from alphabetical lists of farmers in each police district.

On examining the returns, the following criteria for resolving types of farming were adopted. A specialised farm was defined as one deriving 75 percent or more of its gross income from a single enterprise, while a dominant enterprise was defined as one contributing at least 50 percent to the farm income, and a subsidiary enterprise as one contributing less than 30 percent. A farm was classified as mixed if two enterprises each contributed between 30 and 60 percent of the gross return.

Only 291 farmers returned schedules suitable for classification. Although their farms were fairly well distributed through the main farming belt of the north and east (*Fig.* 2), they revealed such an intermingling of various types over considerable areas that it was found impossible solely on the basis of the survey farms to differentiate farming-type areas. Accordingly, to arrive at the detailed pattern, farmers who had returned questionnaires were interviewed concerning the validity of their farming system as a local type. By this means the probable pattern of farming types in Tasmania was constructed. The field survey was not completed until 1960.

Farming-type areas were defined on the basis of a minimum of either five contiguous farms or five hundred contiguous acres devoted to a particular type of farming. This gave a pattern of striking complexity, but on close examination it fell fairly clearly into nine principal farming-type regions and twenty-seven subregions (*Fig.* 1).[1] Each of these regions and subregions will be briefly reviewed.

Far Northwest Dairying Region

The Far Northwest consists of low, recently emerged, erosion surfaces originally and still largely covered with wet sclerophyll forest, heaths, button-grass plains, swamps and, on the higher inland areas, rainforest.[2] Average annual rainfall ranges from 37 inches at Cape Grim in the extreme northwest to 56 inches at Trowutta; on the southernmost bush runs along the coast it is typically 50 to 70 inches.[3] Farming has been largely confined to land cleared from the sclerophyll forest and reclaimed from the swamps. The predominant type is dairying, but there are extensive areas of beef-cattle grazing, and, near Cape Grim, mixed sheep and cattle grazing. Both physically and economically, King Island, which was not included in the farm survey, represents a detached portion of the region.

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[1] Compare A.G. Lowndes and W. H. Maze: 'Land Utilization Regions of Tasmania', *University of Sydney Publications in Geography, No. 4*, Sydney, 1937; and Peter Scott: 'The Agricultural Regions of Tasmania: A Statistical Definition', *Econ. Geog.*, Vol. 33, No. 2, April 1957, pp. 109–121.

[2] For maps depicting the soils and pre-European vegetation of Tasmania see C. G. Stephens: 'The Soils of Tasmania', *C.S.I.R. Bull. No. 139*, Melbourne, 1941.

[3] For maps depicting *inter alia* the relief, geology, soils, average annual rainfall, climatic regions, livestock and crop distributions see the *Regional Planning Atlas, Economic Resources of Tasmania*, (Third edition, c. 1955), published by Directorate of Industrial Development.

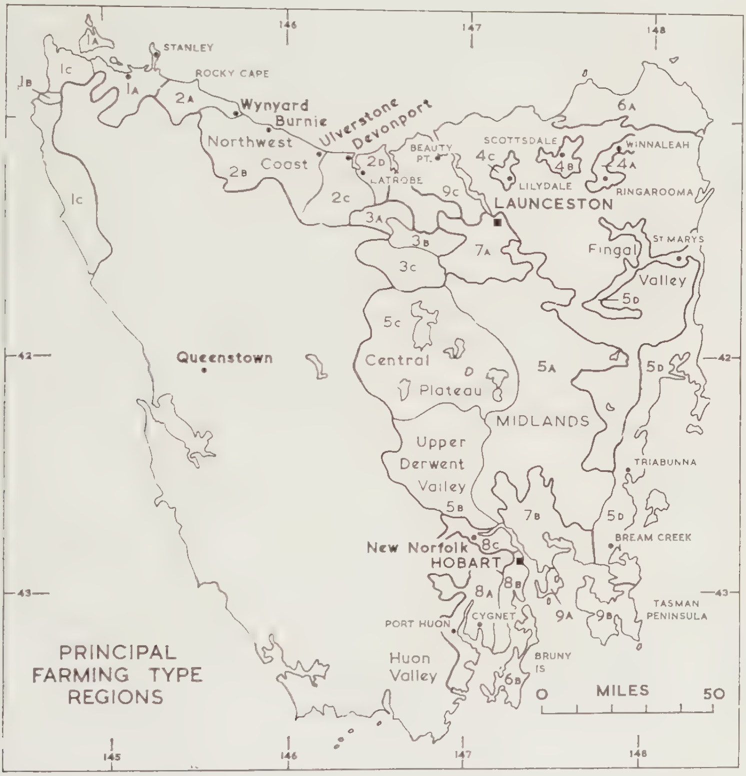

Fig. 1. Farming-type regions of Tasmania: 1. Far Northwest Dairying; 2. Northwest Coast Mixed-Farming and Dairying; 3. Deloraine Dairying and Mixed Livestock; 4. Northeast Dairying and Mixed Farming; 5. Midlands Grazing; 6. Minor Grazing; 7. Intensive Sheep Farming; 8. Southeast Horticultural; 9. Minor Horticultural

The Far Northwest comprises two separate subregions of improved farmland: Smithton-Trowutta (1A in *Fig.* 1) and Marrawah-Redpa (1B). However much of the heathland to the north of Redpa and much of the plains to the south are used for the winter grazing of dry dairy stock and for running beef cattle (1C), the stock deriving from both subregions.[4] Farms are predominantly between 100 and 500 acres in extent (*Fig.* 3). Since the region experiences not only a heavy rainfall

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[4] For details of these stock movements see Peter Scott: 'Transhumance in Tasmania', *N.Z. Geographer*, Vol. 11, No. 2, October 1955, pp. 167-169.

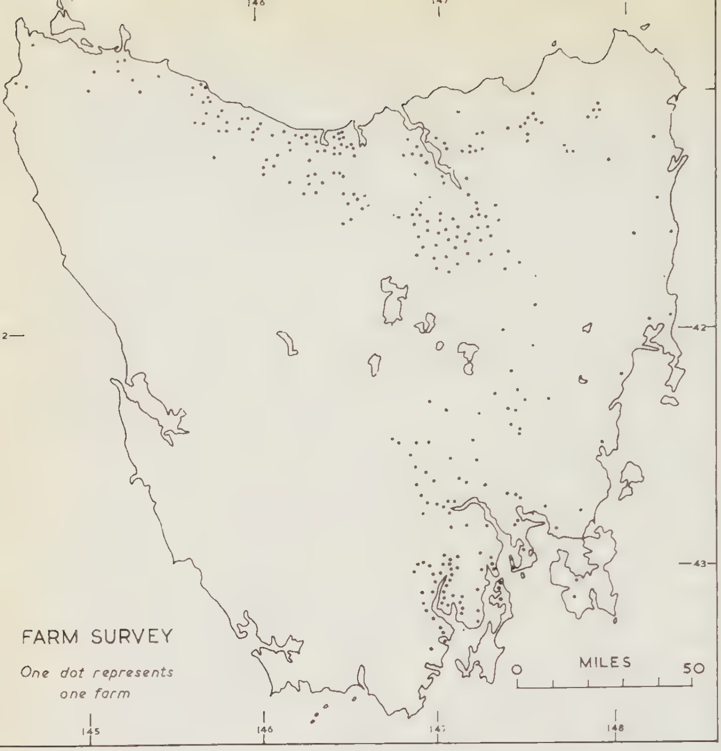

Fig. 2. Farms returning questionnaire, 1954

but also more raindays a year than any other settled area of Tasmania, the carrying capacity of sown pastures is remarkably high. The region is served by a butter factory (*Fig.* 4),[5] a bacon factory and a pea cannery at Smithton, by cheese factories at Broadmeadows and Montagu, and by the port of Stanley.

The Smithton-Trowutta subregion may be further subdivided into two: the Smithton-Stanley-Forest tract, which occupies a basalt flow and is devoted to dairying with subsidiary cash cropping (potatoes for mainland markets and peas for canning), or subsidiary fat-lamb raising, or subsidiary beef production; and the rest of the subregion, which has podsolic soils not rich enough for profitable cash cropping and is devoted to specialised butterfat and pigmeat production. Beef cattle are run on unimproved country adjoining the farmland. The subregion has the second highest density of dairy cattle in the state. In the south herds approximate to the state average of 35 milking cows in 1959–1960, and in the north average more than 50, but yields per cow, which range from 265 pounds of butterfat in the south (state average 260 pounds) to only 235 in parts of the north, are low. Smithton-Trowutta

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[5] Production statistics for individual dairy factories were kindly made available by the Chief Dairy Officer of the Tasmanian Department of Agriculture on condition that they were portrayed cartographically and the precise output of the individual factories not disclosed.

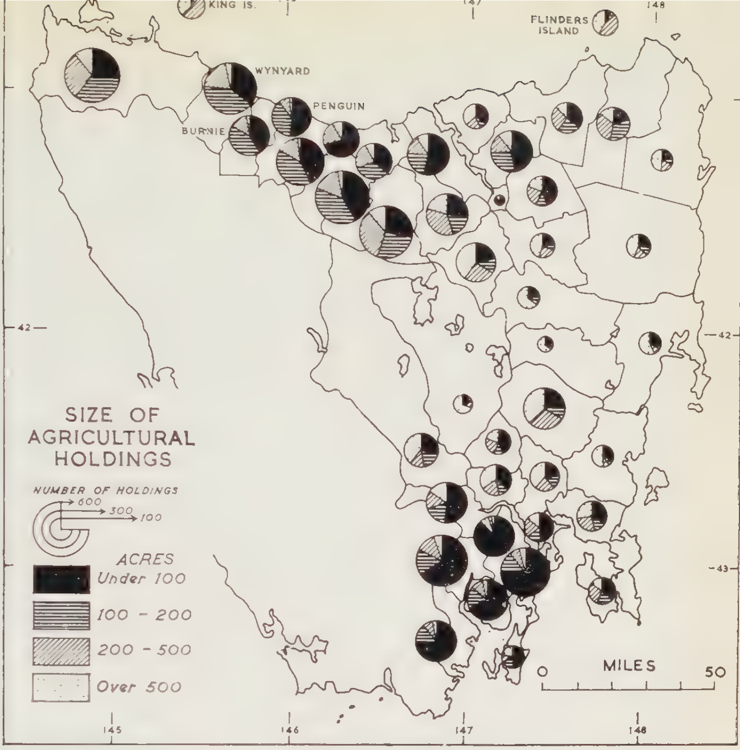

Fig. 3. Size of agricultural holdings, 1955-1956

is the premier district in Tasmania for growing turnips both for stock feed and cash. A few wholemilk producers occur near Smithton. Stock sales are held weekly at Smithton, monthly at Irishtown and Black River, and quarterly at Lileah and Trowutta (*Fig.* 5).[6]

In the Marrawah-Redpa subregion (*Fig.* 6), which has the highest density of dairy cattle in the state, herds are typically of from 50 to 55 cows in milk, but yields per cow are only a little above the state average. Although basaltic red loams occur at Marrawah, the district is too remote nowadays for cash cropping, and virtually the only occupation is specialised butterfat and pigmeat production. Some beef cattle and a few sheep are carried as sidelines, but only on a few farms. Quarterly stock sales are held at both service centres.

NORTHWEST COAST MIXED-FARMING AND DAIRYING REGION

The Northwest Coast mixed-farming and dairying region includes the seaward slopes of the basalt plateau together with the coastal platforms around Rocky Cape and a portion of the northern rift valley east of Latrobe. Average annual rainfall decreases eastwards from 45 inches near Rocky Cape to 30 inches in the east, there being 38 at Latrobe; it also increases rapidly as the plateau surface rises inland, reaching some 60 inches at the fringe of settlement. Except near Rocky Cape the region is characterised by red loams which, combined with the generally small size of farms (mostly much less than 150 acres), have given a strong emphasis to cash cropping. Accordingly, dairy herds are small, the average being 25 milking cows, and butterfat yields per cow approximate to the state average, though near Rocky Cape herds are larger (35 milking cows on an average) and more productive (average 280 pounds butterfat per cow). The Northwest Coast, which, with the Lilydale mixed-farming district, is the most densely settled country in the north, falls into four farming-type subregions.

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[6] Figure 5 has been based on an analysis of the stock-sale advertisements which have appeared in the three Tasmanian daily newspapers: the *Mercury* (Hobart), the *Examiner* (Launceston), and the *Advocate* (Burnie and Devonport).

Rocky Cape and Burnie Subregions

The Rocky Cape subregion (2A) is essentially transitional between the dairying Far Northwest and the mixed-farming basalt plateau. Strictly speaking, its farming type resembles that of the Smithton area, but at Rocky Cape specialised dairying, which dominates the Far Northwest, is absent, and subsidiary enterprises contribute more to the farm income than around Smithton; economically, moreover, the area is an integral part of the Northwest Coast. It comprises two east-west tracts of dairying with subsidiary enterprises, separated and bordered on the west by extensive heathlands used for beef-cattle grazing. A few wholemilk producers occur near Wynyard. The subregion is served by the Wynyard butter factory, but for other marketing services it is dependent on Burnie.

Southeastwards and focusing on Burnie lies a large subregion of mixed crop and livestock farming on the northwestern plateau (2B). This plateau, which is probably similar in origin to the higher surfaces of the west coast but has been much modified by Tertiary basalt flows, slopes northwards from about 2,000 feet. It is drained by numerous subparallel streams incised below the generally even surface of the plateau. The farmland, which is largely confined to the interfluves, has the highest proportion of arable, and carries the highest density of tractors, in northern Tasmania. (Peak densities are reached in the Huon.) Immediately behind Burnie, potatoes grown for export to the mainland rank as the premier crop, but elsewhere in the subregion, as throughout the rest of the north, the hay crop takes pride of place. Near Ulverstone green peas are grown for canning. Most of the subregion comprises mixed potato and dairy farms with specialised potato farms and beef-cattle grazing near the inland fringe and a few wholemilk producers along the coast. The subregion is served by butter factories at Wynyard, Yolla, Burnie and Ulverstone, by the Somerset meatworks west of Burnie, by a cannery at Ulverstone, weekly stock sales at Cooee and Ulverstone, and by the ports of Ulverstone and, especially, Burnie.

Sheffield and Latrobe Subregions

The Devonport-Sheffield subregion (2C) is more complex. It comprises an extensive tract of mixed crop and dairy farming around Sheffield, and numerous smaller tracts of dairying with subsidiary enterprises, such as around Forth and Wilmot. South of Sheffield there is also some fattening of both sheep and cattle with subsidiary enterprises, while southwest of Sheffield beef cattle are grazed. Since the land surface tends to be more broken than on the central portion of the northwestern plateau, the area has a high density of draught horses—in fact, the highest in the north. (The Huon Valley has the state maximum.) It also has the highest proportion of improved to total pasture of any subregion in the state, and makes a greater use of hay than elsewhere. Blue peas, as well as potatoes and canning peas, are important. A few wholemilk producers occur near the coast. Devonport has a cannery and a butter factory, and is the port of both this and the Latrobe subregions. However, Sheffield is the main centre for stock sales, which are held each fortnight.

But it is the Latrobe subregion (2D) which shows the greatest diversity of farming type. Eastwards from Devonport dairying with subsidiary enterprises, mostly for wholemilk production, gives place to mixed crop and dairy farming and, on larger farms along the coast, to mixed sheep farming and cash cropping with subsidiary beef and dairy production. Further east still, near the northeastern extremities of the basalt flows within the rift valley, farming is typically mixed dairy and fat-lamb production with subsidiary cash cropping. Although cash cropping is here a sideline, farms tend to be larger than elsewhere in the northwest, and cereal and pulse crops occupy a considerable acreage. The Latrobe subregion is the foremost barley-growing district of Tasmania, both by acreage and by yield per acre, and provides the state's highest average wheat yields. Moreover, dairy herds are slightly larger and far more productive than elsewhere on the Northwest Coast, averaging 30 cows in milk with an average butterfat yield of 295 pounds per cow. The subregion is also important for its apple and pear orchards around Latrobe, though orcharding is handicapped by transport problems. Latrobe is linked by road with the oversea fruit-shipping port of Beauty Point only via Launceston, so that most growers depend on mainland (via Devonport) and Tasmanian markets. Except for stock sales, which are held weekly at Latrobe, the principal service centre for the subregion is Devonport.

Deloraine Dairying and Mixed Livestock Region

In contrast to the Latrobe subregion, the Deloraine dairying and mixed livestock farming region lies inland, is everywhere above 500 feet, and is exposed, cold and prone to early autumn and late spring frosts. The rainfall is also somewhat higher, being typically from 35 to 40 inches, except at Mole Creek where it reaches 45 inches. Throughout the main farming areas traversed by the Bass Highway the occurrence of red loams within the North Midland rift valley permits extensive pasture development and the cultivation of pulse crops and cereals. But around Elizabeth Town (3A) the predominant farming type is dairying with subsidiary cropping and fat-lamb raising, while in the drier Deloraine area (3B) it is mixed fat-lamb raising and dairying, mostly with subsidiary cash cropping and some beef-cattle fattening. Dairy herds, though fairly large on the average (40 cows in milk), have a somewhat poor performance per cow (average 260 pounds of butterfat), though it should be emphasised that, as at Latrobe and Smithton, the return from dairying per acre is outstandingly high. As the rainfall continues to decline eastward from Deloraine, sheep farming becomes increasingly important; the eastern boundary to the region broadly coincides with the limit of the red loams. Windbreaks comprising avenues of introduced pines are a distinctive feature of the Deloraine landscape. Deloraine has a butter factory and holds fortnightly stock sales, but the region grows canning peas for the Devonport factory and supplies fat stock to the Launceston meatworks.

South and southwest of Deloraine lies the hill country bordering the western ranges (3C). Here dairying in the valleys with subsidiary sheep and cattle grazing on the hills occurs along the Mersey around

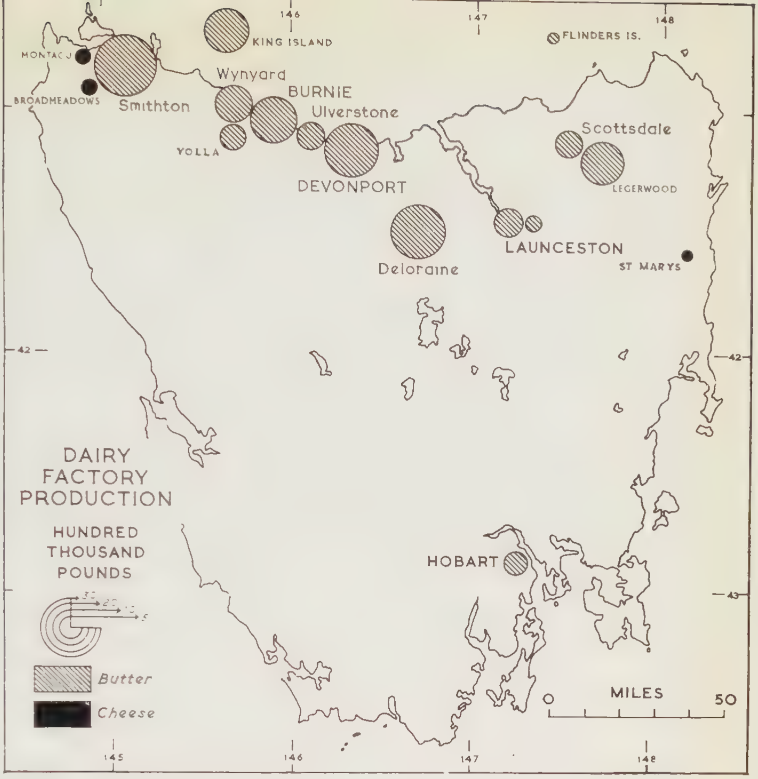
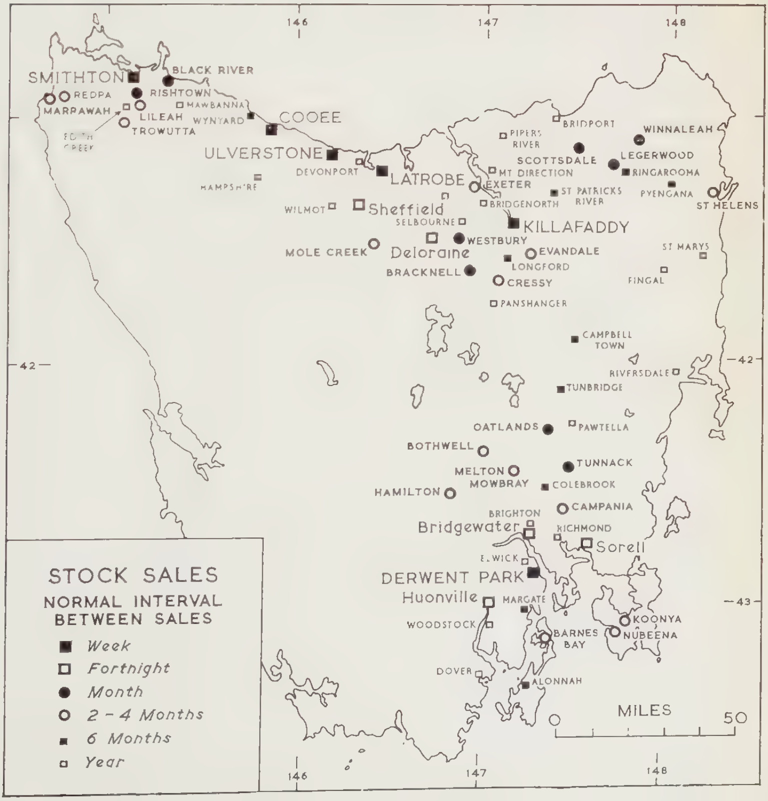


Fig. 4. Dairy factory production

(See footnote 5)



(See footnote 6)

Fig. 5. Normal interval between stock sales

Fig. 6. Pioneer dairy farm near Marrawah. The ringbarked eucalypts are a striking feature of the Tasmanian landscape. (*Photo:* Tasmanian Department of Education)

Mole Creek and in Golden Valley south of Deloraine. In spite of its name Golden Valley has thin, poor soils and a heavy rainfall, and its pastures, even of sown grasses and clovers, are mostly infested with thistles, bracken and blackberry. South of Mole Creek mixed sheep and cattle grazing is widespread. In general, the hill country is characterised by marginal farming. Mole Creek holds quarterly stock sales.

Northeast Dairying and Mixed Farming Region

In the northeast dairying and mixed crop and livestock farming are largely confined to the basalt flows within or on the margins of the northeastern highlands and at altitudes mostly above 500 feet. The most extensive occurrence is the arc-shaped area extending from northeast of Winnaleah to south of Ringarooma (4A). This subregion lies wholly within the highlands, rises to more than 1,000 feet south of Ringarooma, and has a rainfall of from 45 to 50 inches; and farming is largely coterminous with the red loams. Dairy herds average 35 milking cows, and butterfat yields average as high as 300 pounds per cow. The area is the most important in the northeast for turnips, and the most important throughout the dairying north for oats; both are grown for stock feed only. The predominant type of farming is dairying with subsidiary fat-lamb raising or beef production, but in places,

Fig. 7. Raking up a pea crop near Scottsdale. The scattered native trees provide shelter, as contrasted with the northwest where forest was clear-felled. (*Photo*: Tasmanian Department of Education

notably east and south of Ringarooma, mixed sheep and cattle farming becomes dominant, the stock being grazed on the podsolic lands bordering the basalt. The subregion is served by a butter factory at Legerwood, the nearest point on the railway to Launceston, and monthly stock sales are held at Legerwood and Winnaleah. Fat stock, as from the entire northeast, are processed at Launceston.

Scottsdale (4B) and Lilydale (4C) are both basalt-filled basins on the margins of the northeastern highlands, and both receive an average annual rainfall of about 40 inches. Scottsdale is bordered on three sides by forested mountains, but opens northwards on to the coastal platforms where the rainfall decreases rapidly towards the coast. Around Scottsdale the rolling basalt surface is used for mixed crop and dairy farming on small farms (*Fig.* 7). These furnish a variety of vegetables to the Scottsdale processing factory and potatoes for the Hobart and Launceston markets. Westwards mixed farming merges into dairying with subsidiary cash cropping and fat-lamb raising on larger farms, while northwards and especially northeastwards on the sandy coastal platforms it merges into mixed sheep and cattle grazing and fattening on the largest farms in the district. Stock sales are held monthly at Scottsdale. Dairy herds average 30 cows in milk and butterfat yields are 280 pounds per cow.

Lilydale has a higher proportion of small farms than any other northeastern district. Around Lilydale orcharding is combined with a small tract of mixed crop and livestock farming in the south and with an extensive tract of dairying with subsidiary enterprises in the north. Dairy herds average 35 cows in milk but average yields of butterfat are as low as 245 pounds per cow, or little more than the economic minimum of 240 pounds for a herd of that average size. In this hill area the density of rural population is the highest in the northeast. For service provision Lilydale is dependent on Launceston.

In addition to the three main subregions, a number of small flood plains and small basalt basins within the northeastern highlands are used for dairying. Foremost among the flood plains is a linear tract of specialised dairying aligned along the St Patricks River valley northeast of Launceston. Another such area lies along the Piper River northwest of Scottsdale. The small basalt basins are mainly located between Ringarooma and St Helens; they carry dairying with subsidiary enterprises, but much of the farming would seem to be marginal. St Patricks River and Pyengana hold stock sales twice a year, and Pipers River holds yearly sales.

Midlands and East Coast Grazing Region

The principal wool-growing region embraces the Midlands, the upper Derwent Valley, the Central Plateau, the Fingal Valley, and the east coast. Almost the entire region has a rainfall of less than 30 inches.

The Midlands (5A) may be subdivided into a northern area which occupies the relatively flat floor of the North Midland rift valley and slopes northwards from 1,000 to nearly 500 feet, and a southern area, which is everywhere above 1,000 feet and occupies the dissected dolerite plateau. Farms tend to be substantially larger (typically over 5,000 acres) in the rift valley than in the southern hill country (typically less than 2,000 acres). But the entire Midlands, rift valley and hill country alike, are characterised by extensive sheep farming on native pastures for fine wool and store sheep, generally with subsidiary cattle rearing, but locally with either subsidiary livestock fattening or subsidiary cereal cropping. The subdivision of former pastoral estates has led to fat-lamb raising as the dominant activity on some farms near Pawtella, to mixed dairying and fat-lamb raising near Oatlands, and to mixed seed-potato growing and dairying in several localities near Tunnack. Elsewhere rotation pastures and cereals are largely confined to alluvial and brown soils developed mostly on Permo-Triassic sediments, and mostly along the Macquarie, Lake, Coal and Jordan Rivers.

A similar pattern of improved pasture and cereal cropping delineates parts of the upper Derwent and Clyde Valleys (5B); this subregion is separated from the southern Midlands by a forested divide which is for most of its length a negative area. Beef-cattle grazing is dominant in parts of the upper Derwent. The Central Plateau (5C), a high undissected dolerite surface, is used almost exclusively for the summer grazing of stock from both subregions.[7] Sheep and cattle are sold not only at sale centres within the region but also in the intensive sheep-farming regions to the north and south. The leading sheep sales are held at Evandale, Oatlands and Bridgewater, and the leading cattle sales at Oatlands and Bothwell. The wool clip is auctioned at sales held each year at Launceston and Hobart in February and May respectively.

The Fingal Valley and the east coast (5D), like the Midlands, are together a subregion of fine-wool growing with some subsidiary store-cattle production. Along the South Esk Valley northwards and southwards from Fingal, improved pastures occupy Tertiary lake sediments, but this Tertiary occurrence is separated from the North Midland Plain by a tract of dolerite hill country still clothed in dry sclerophyll forest. From Fingal to St Marys, as along so much of the

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[7] For details see Scott: 'Transhumance in Tasmania', *op. cit.*

Fig. 8. Extensive pastoralism on the east coast. Beyond the coastal plain dry sclerophyll forest, used as a drought reserve for sheep, mantles the low dissected dolerite plateau. (*Photo:* Tasmanian Department of Education)

east coast, sheep farming is concentrated on Permo-Triassic sediments, but unlike much of the east coast of the Fingal-St Marys area has a sufficiently high rainfall (30 inches) to justify the development of rotation pastures. Around Fingal and the coal-mining St Marys, partly to supply local liquid-milk requirements and partly for butterfat and cheese production, dairying is dominant.

Along the east coast (*Fig.* 8) extensive sheep grazing on native pastures prevails throughout, and only locally are limited tracts of alluvial soils used for improved pasture. At Triabunna orcharding is dominant, but in the south it now ranks as a small and declining enterprise on a few farms only. At Bream Creek permanent pastures on a basalt dome receiving from 30 to 35 inches of rain a year support specialised wholemilk production for the Hobart market.

Minor Grazing Areas

Two outliers of extensive pastoralism were distinguished: the Far Northeast and Bruny Island. On the coastal platforms of the Far Northeast (6A), where the rainfall is below 30 inches, sheep are grazed on heathlands and native pastures, but towards the coast extensive tracts of damp low-lying land are used solely for raising store cattle. Near Bridport there is some specialised vegetable growing for the Scottsdale factory, while east of Bridport the land has recently been developed for fat-lamb properties under a soldier settlement scheme; west of Bridport extensive sheep farming reappears in several small isolated tracts. Flinders Island, which was not included in the farm survey, may be regarded both physically and agriculturally as a detached portion of the Far Northeast. Bruny Island (6B) has some wool growing in the north, but the south, which is generally too rugged and too wet for farming, carries merely a few orcharding properties on coastal sites.

Intensive Sheep-Farming Regions

The intensive sheep-farming region around Longford and Cressy (7A), which has by far the highest sheep density in the state, occupies the northern half of the Tertiary lake sediments within the rift valley; the southern half, where the rainfall is lower and more variable, forms part of the Midland wool-growing region. Predominantly the North Midland sheep region is characterised by fat-lamb raising with subsidiary cash cropping of oats, wheat, barley and grey peas, and occasionally subsidiary cattle enterprises as well. It is, incidentally, the premier Tasmanian region for the cultivation of cereal and pulse crops. However mixed sheep farming for both fat lambs and fine wool occupies almost as large an area as fat-lamb raising itself, being particularly widespread in the drier south and east. Locally, such as on the dolerite tracts of the centre and north, fine-wool growing with subsidiary enterprises reappears as the dominant system, while southeast of Launceston wholemilk production and market gardening assume some local importance. Cressy is the leading centre for stock sales, even though Bracknell holds sales more frequently; fat stock are marketed at Killafaddy.

The southern intensive sheep-farming region (7B) is also distinguished by the predominance of fat-lamb raising, even though the rainfall here is for the most part considerably lower (19 to 26 inches, but generally between 19 and 21 inches) than on the North Midland Plain (25 to 31 inches) and some irrigation is essential. The region includes some tracts of highly fertile lowland and valley soils, mostly alluvial soils, black earths and brown soils, which repay not only intensive pasture management but also subsidiary cropping for cereals and peas. Everywhere wool growing tends to be a subsidiary enterprise, being confined to the open savana woodland on the northwest-southeast fault-guided ranges. South of Richmond mixed dairying for wholemilk and fat-lamb raising holds sway, around Sorell dairying with subsidiary cropping and fat-lamb production, and around Colebrook mixed dairying and cash cropping. Horticulture, notably apricot growing, is locally a significant subsidiary enterprise, chiefly on the warm northeastward-facing slopes south of Richmond and west of Sorell; market gardening by a small Chinese community occurs on the alluvial terraces of the Coal River near Richmond. Although fortnightly stock sales are held at Sorell and quarterly sales at Campania, the region depends primarily on Hobart for marketing services, and fat stock, for example, are sent to Derwent Park.

Southeast Horticultural Region: The Huon Valley

The outstanding district within the southeastern horticultural region and the most densely settled farming district in Tasmania is the Huon Valley (8A). Its long gentle slopes, its podsolic soils developed on

Permian mudstones and Triassic sandstones, its rainfall of from 30 to 40 inches, and its abundant sunshine combine to make the valley eminently suited to orcharding. Its only other farm specialities are of minor significance; they include small fruits in the northeast towards Hobart and hops at Ranelagh just northwest of Huonville.[8] But on the east bank around Woodstock and Cygnet orcharding and especially small-fruit growing are declining in favour of wholemilk production for the expanding Hobart market; dairying tends to be either a subsidiary or an exclusive enterprise. On the west bank dairying is also developing, but predominantly as a sideline and for butterfat for despatch to Hobart. Around and upstream from Huonville, alluvial soils too wet for apple growing have been converted to fattening pastures, but in places, notably near Huonville on the most extensive tract of alluvium in the valley, apples have merely been replaced by pears. West of Port Huon, despite a marked concentration of orchards, much of the cleared land is rough grazing on which beef cattle are run, while in the far south fattening farms reappear around Dover. There orcharding tends to be handicapped by the occurrence of hail, almost unknown in the northern Huon, for hail is associated with southwesterly air streams to which the far south is exposed. A more critical handicap to orcharding in the south has been the high road-transport costs of fruit exports through Hobart, though the opening of Port Huon in 1954 has helped to alleviate this problem. The valley contains a large number of fruit-processing factories, located mainly in Huonville and Cygnet. Huonville holds a fortnightly stock sale and Cygnet an annual Huon Valley Apple Festival.

D'Entrecasteaux Channel Coast

The D'Entrecasteaux Channel coast (8B) is also predominantly an orcharding district, but small fruits are relatively much more important than in the Huon and orcharding is declining far more rapidly. Permo-Triassic sediments are again the basis of agricultural development, but the predominance of dissected dolerite restricts agriculture to limited areas. Rainfall is lower than in the Huon, ranging from 35 inches in the south to 25 inches in the north. On alluvial terraces at Margate both hops and raspberries are grown, the irrigated raspberry crop giving the highest yields in the state. In this drier north berry-fruit farms, producing mainly blackcurrants and raspberries, are largely confined to forest hill clearings, but in the wetter south loganberries and raspberries, together with some blackcurrants and gooseberries, are grown as subsidiary enterprises on coastal farms. Orchards occur throughout the Channel belt, but plums are grown mainly in the north and pears in the higher-rainfall south. Orcharding is declining in favour of dairying, particularly in the north. Beef-cattle grazing, which ranks as an occasional sideline to either fruit growing or dairying, is found only in the south, and subsidiary sheep rearing, mainly for fat lambs, only in the north. Market gardening is important on small coastal holdings near Hobart, while subsidiary potato growing occurs everywhere, notably in the far south. Since the Channel coast has easy access by road to Hobart, there is within the region no stock sale of importance and only one fruit-processing factory.

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[8] See Peter Scott: 'Die Spezialisierte Landwirtschaft Südost-Tasmaniens', *Die Erde*, Vol. 86, No. 3-4, 1955, pp. 272-285; and *idem*: 'The Tasmanian Apple and Pear Industry', *Geography*, Vol. 44, Pt. 1, January 1959, pp. 47-49.

MIDDLE DERWENT VALLEY

The Middle Derwent Valley (8c) is pre-eminently the hop region of Tasmania, but small-fruit growing, orcharding, sheep farming, dairying and some local fattening combine to give complex patterns of farming type. The country is mainly dissected dolerite plateau with a rainfall of about 21 inches, so that the basic activities are wool growing with some subsidiary cultivation and cattle grazing. Around Bushy Park, the core area of hop gardens northwest of New Norfolk, the landscape presents a striking contrast between the most intensive type of Tasmanian farming on the river terraces and the most extensive type on the plateau above. Immediately adjoining the hop gardens, however, are improved pastures which enable fattening to supplement wool and horticultural production; farther northwest at Glenora fattening even becomes the dominant enterprise. Along the Derwent hop growing is locally the major source of farm income (*Fig.* 9), but along most of the Derwent tributaries hops are merely an adjunct to other activities. Everywhere orcharding, which has survived only by the adoption of irrigation, is merely a sideline. The principal Tasmanian areas of small-fruit farms are located in the hills south of New Norfolk; small fruits are processed at New Norfolk and Hobart. In a few localities between Hobart and New Norfolk dairying for urban milk supply is dominant, but beyond New Norfolk dairying is

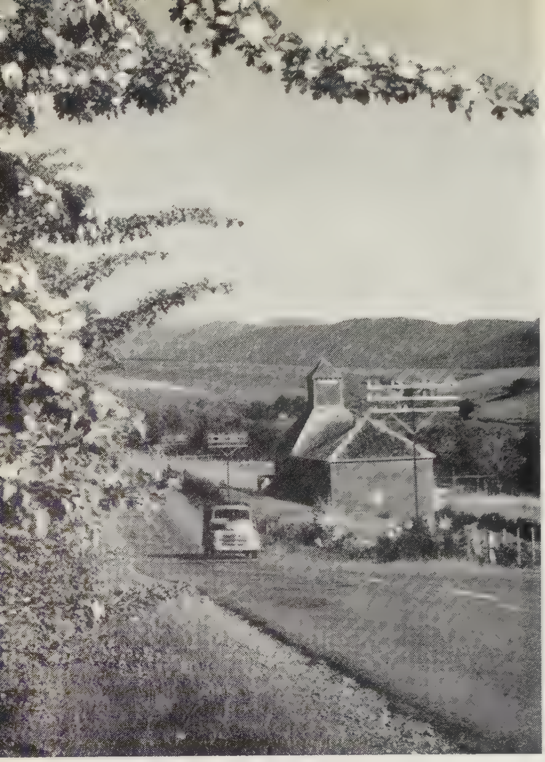
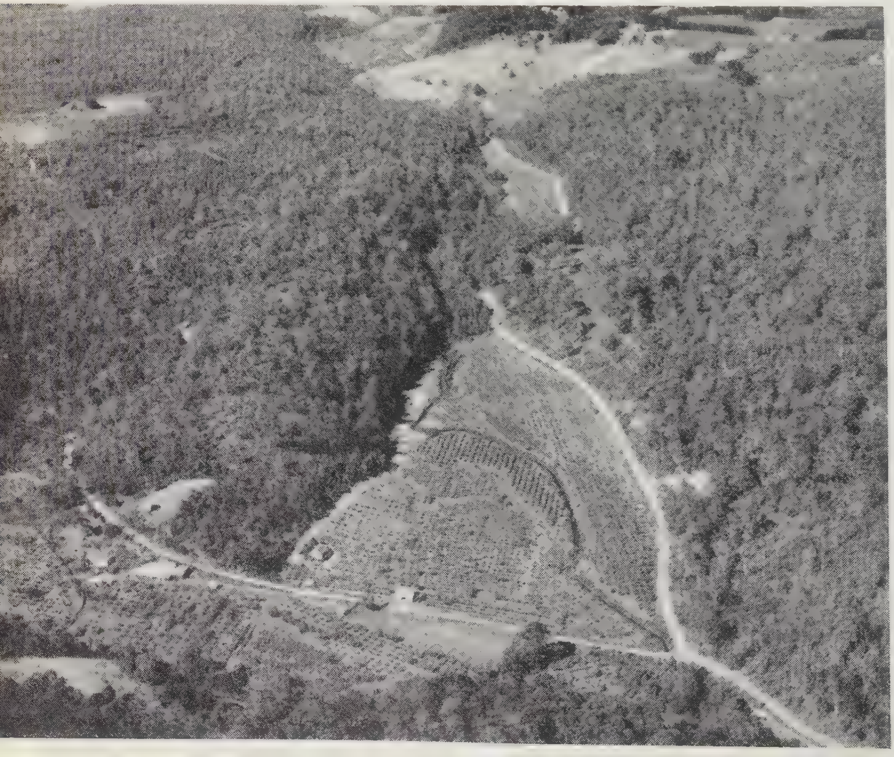


Fig. 9. The middle Derwent Valley near Hayes—hops on the alluvial terrace below the kiln, sheep pastures to the south, and forested slopes of the high, dissected dolerite plateau beyond. (*Photo*: Tasmanian Government Photographic Laboratory)

g. 10. Apple and pear orchards on alluvial soils within the wet sclerophyll forest at Nubeena on e Tasman Peninsula. (*Photo:* Tasmanian Department of Education)



primarily for butterfat production. Market gardening is restricted to alluvial tracts near New Norfolk and Hobart. The entire region looks to Hobart for stock sales and other services.

MINOR HORTICULTURAL AREAS

Of the remaining horticultural areas the most diversified in fruit type is the sheltered lowland of the East Derwent Peninsula (9A), which has a markedly drier (22-inch rainfall) and sunnier climate than the western bank of the Derwent. Although the dominant farming type in the area is sheep farming, a characteristic subsidiary enterprise is apricot growing, while specialised farms with mixed apricot and pear orchards occur on sheltered sites in the northeast. Locally a combination of easily-worked soils, an equable frost-free climate, an abundance of sunshine, and the availability of irrigation water permit specialisation in early vegetables for the Hobart market.

On the rugged, mountainous Tasman Peninsula (9B), where a heavier rainfall (30 to 40 inches) derives from southwesterly air streams, apple and pear orchards characterise the lower coastal slopes and valleys (*Fig.* 10), particularly in the north, while dairying with subsidiary sheep farming and potato growing typifies the higher inland areas. However, the orchardists suffer losses occasionally from hail, and both orchardists and dairy farmers incur high transport costs on fruit and butterfat respectively because of the long hauls over bad roads to Hobart. Quarterly stock sales are held at Nubeena and Koonya.

But the most important of the remaining horticultural areas is the West Tamar (9C). This area resembles the Huon in that it contains extensive tracts of Permo-Triassic sediments and receives from 30 to 40 inches of rain a year, but the slopes are more gentle and there are extensive areas where the presence of a hardpan precludes orcharding. The West Tamar has a comparative advantage in pear production, since because pears blossom later than apples they are less prone to frost damage along the Tamar than in southern Tasmania. Although orcharding is the most important farming type on the West Tamar, towards Launceston, on the Permo-Triassic sediments, orcharding is interspersed with mixed dairying and fat-lamb production, often with subsidiary wool-sheep grazing on partially cleared parts of the holdings, and even with some potato growing. Locally, dairying is dominant. Northwestwards, as the rainfall decreases towards the coast and older rocks replace the Permo-Triassic, much of the land remains as semicleared dry sclerophyll forest, carrying sheep and a few store cattle at very low stocking rates. The West Tamar is dependent on Killafaddy, Exeter and Bridgenorth for stock sales, on Beauty Point for fruit shipment, and on Launceston for the marketing of butterfat, wholemilk and wool.

Gross Output of Regions

It remains to assess the relative importance, by farming area and the value of the gross output, of each of the principal farming-type regions. The value of the gross output was computed for each police district by allocating average values for livestock and crops,[9] most of the values being the same as those used by the Commonwealth Bureau of Census and Statistics to determine the gross output of Tasmanian agriculture in 1959–1960. Although the present method of computing gross output has been used by Wilson to define types-of-farming areas in Victoria,[10] it would not have been possible to define farming-type areas in Tasmania by this means, largely because of the juxtaposition of various types within many districts. In calculating the estimated values given in Table I, farming on the Bass Strait islands, together with poultry and bee farming throughout Tasmania, were excluded. Since the boundaries of police districts and farming types did not coincide, it was necessary to adjust the estimated values for some districts by reference to the farming types present and the sample gross incomes of the survey farms. However, the principal farming-type regions are for the most part sufficiently large to reduce to small proportions the probable error arising from this adjustment.

The resultant estimates of the value of gross output highlights four regions: in order, the Midland extensive sheep-farming region, the Northwest Coast mixed-farming and dairying region, the southeast horticultural region, and the two intensive sheep-farming areas (Table I). Next comes a secondary group: the northeast dairying and mixed farming region, the Deloraine dairying and mixed livestock farming region, minor horticultural areas, and the Far Northwest dairying region. The minor grazing areas make an insignificant contribution to the Tasmanian gross output.

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[9] For a full account of the method employed see Commonwealth Bureau of Census and Statistics: *Types of Rural Holdings in New South Wales: A Method of Classification and its Application, 1955–56*, Canberra, 1957.

[10] R. K. Wilson: *Types-of-Farming Areas in Victoria*, Unpublished Ph.D. thesis, Australian National University, Canberra, 1959.

However the farming-type regions rank differently by physical efficiency. It is scarcely surprising that in gross output per acre the southeast horticultural region stands pre-eminent, for hops alone gave a gross return of £A615 per acre in 1959–1960. It is however pertinent that, of the predominantly pastoral regions, Deloraine takes pride of place, closely followed by the Northwest Coast. Then come the intensive sheep-farming areas, the minor horticultural areas, and the northeast dairying tracts. The Far Northwest ranks low because the region comprises a restricted area of highly intensive dairying and large areas used for extensive sheep and cattle grazing. Lastly, the extensive sheep-farming regions, which account for nearly three-fifths of the entire farming acreage, give the lowest return per acre.

TABLE I

ESTIMATED ACREAGE AND ESTIMATED VALUE OF THE GROSS OUTPUT OF THE PRINCIPAL FARMING-TYPE REGIONS, 1959–1960

Region	*Estimated Acreage**	*Estimated Gross Value of Output*	
		Total (£A)	*Per Acre (£A)*
1. Far Northwest Dairying ..	415,320	1,856,670	4.5
2. Northwest Coast Mixed-Farming and Dairying	430,680	7,251,000	16.5
3. Deloraine Dairying and Mixed Livestock	147,860	2,659,400	18.0
4. Northeast Dairying and Mixed Farming	291,620	3,529,000	12.1
5. Midlands Grazing	2,522,630	8,875,970	3.5
6. Minor Grazing	305,960	160,950	0.5
7. Intensive Sheep Farming ..	359,205	5,003,880	13.9
8. Southeast Horticultural ..	242,065	6,245,400	25.8
9. Minor Horticultural ..	175,860	2,157,770	12.3
Totals and average	4,899,200	37,740,040	7.7

*Excludes freehold land and Crown leases not used agriculturally in 1959–1960.

CONCLUSION

It is in fact symptomatic of the pattern of Tasmanian farming that the three outstanding regions by value of gross output are also distinguished by the use made of the factors of production. Although no satisfactory data exist for determining areal variations in the input of labour and capital, the salient regional variations are readily discernible. In brief, the southeast horticultural region is pre-eminent for its intensive use, particularly in orcharding and hop growing, of all the production factors. On the other hand, the Northwest Coast, which ranks third in returns per unit area, would seem to require a more intensive use of land and a further substitution of capital for labour if many of its farms are to become markedly supermarginal. Lastly, the Midland sheep region is extensive in land use but gives a high return per unit of labour and perhaps also to capital as well. Together these three regions, which furnish nearly three-fifths the entire Tasmanian agricultural output, contain some of the richest diversity of the island's rural landscape.

ASPECTS OF RURAL SETTLEMENT IN THE LOWLANDS OF FRANKLIN COUNTY

T. F. KENNEDY

MAN is constantly at work changing the face of the land, moulding it to suit his needs and his desires. Nowhere, perhaps, has he been more successful in the relatively short space of a few decades than in New Zealand. Much of the possible farmland has been utilised in one way or another, and in the physically more favourable areas the transformation has been quite spectacular. In the highly developed rural landscapes typified by the lowlands of Franklin County, man has altered the scene so much that the resulting landscape has, in fact, little in it that is indigenous, although its total pattern is essentially 'New Zealand'.

Examination of the Franklin lowlands shows what man has created from the pre-European cover of bush, scrub, fern and swamp on the two hundred square miles between the Waikato River, the Manukau Harbour, the Hunua Hills and the Awhitu Hills. From a distant vantage point the scene is reminiscent of England—hills of low relief, rolling downs, a hedged and tree-dotted landscape of small fields and close rural settlement, with here and there the clusters of small townships. Closer inspection, however, partly dispels this impression but reveals little that is New Zealand except the farmer and his family, the style of his house and buildings, his methods of farming and his way of life. The present flora and fauna, both domestic and wild, are predominantly exotic in origin, drawn purposely or inadvertently from a variety of oversea sources, and even the tractors, cars and lorries are mainly English and American.

The farmers of Franklin have gathered together a particular complex which admirably suits the climate,[1] the prevailing economic conditions and the farmer's own material and aesthetic tastes, and it is the totality of this cosmopolitan Franklin landscape that is the basis of its New Zealand character. However, it is the farmstead which is distinctively 'New Zealand'—the assemblage of buildings which, together, make possible the efficient production of specialised foods from the land, particularly dairy produce. The layout of the farmstead, the architecture, and the combination of building materials are unlike those of any oversea commercial dairying region, and the farm dwellings especially offer evidence of local architectural evolution.

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[1] The climate is mild with a well distributed rainfall of from 45 to 50 inches, though occasional dry periods occur. Prolonged cold weather or cold wind is rare. Winter sunshine is sufficient to maintain a fair measure of warmth and plant growth.

Although one of Whittlesey's[2] criteria in delimiting world agricultural regions is the assemblage of farm buildings, the actual nature of these varies considerably and is more homogeneous in some regions than in others. The rural scene in New Zealand offers contrasts in this respect, to some extent within the country itself, but especially with comparable agricultural regions overseas. The morphological and architectural differences expressed are a product of historical, economic and technical factors, and of climatic influences, available building materials and social traditions. One basic aim of this paper is to examine the farmsteads of the Franklin lowlands to assess their character and changing nature. A further object is to interpret broadly the evolutionary stages of this very prosperous countryside through the age structure of the farm dwellings.[3]

Farming and Farmsteads

Three basic types of farming are found in the lowlands of Franklin County. Most important is dairying. Sheep farms are in a minority and are hardly efficient or economic on land which is almost everywhere worth at least two hundred pounds an acre. Many dairy farms incorporate sheep rearing in some form but sheep contribute a minor portion of the income. Two important areas of land on basic volcanic soils on and around Pukekohe Hill and nearby Bombay Hill are devoted to market gardening. Although occupying less than five percent of the area under consideration these are the most important vegetable-growing areas in New Zealand and are expanding to meet

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[2] D. W. Whittlesey: 'Major Agricultural Regions of the Earth', *Ann. Assoc. Amer. Geogrs.*, Vol. 26, No. 4, December 1936, pp. 199–240.

[3] Fieldwork for this study consisted of traverses throughout the lowland area, involving inspection of some 1,200 farmsteads and sample interviews with farmers and other persons connected with the farming industry. The area defined in this study as lowland is somewhat arbitrary. In general it is rolling downland from sea level to 400 feet, the greater part being between 100 and 200 feet. However it includes Pukekohe Hill (727 feet) and Bombay Hill (1,030 feet) but excludes the western part of the Awhitu Peninsula. The two hills are included largely because of their relatively easy slope and the nature of the land use—market gardening—whereas Awhitu, although no higher than 860 feet, is relatively rugged, with discontinuous lowland pockets except for the southern half of the eastern part which is included in the survey. The boundary in the southeastern corner of the lowland skirts an area of low steep-sided hills rising to 800 feet, and has as its eastern boundary the Whangarata gap. The lowland continues eastwards towards Maramarua and the Firth of Thames but this portion of the county is excluded from this study. (See Figure 1.)

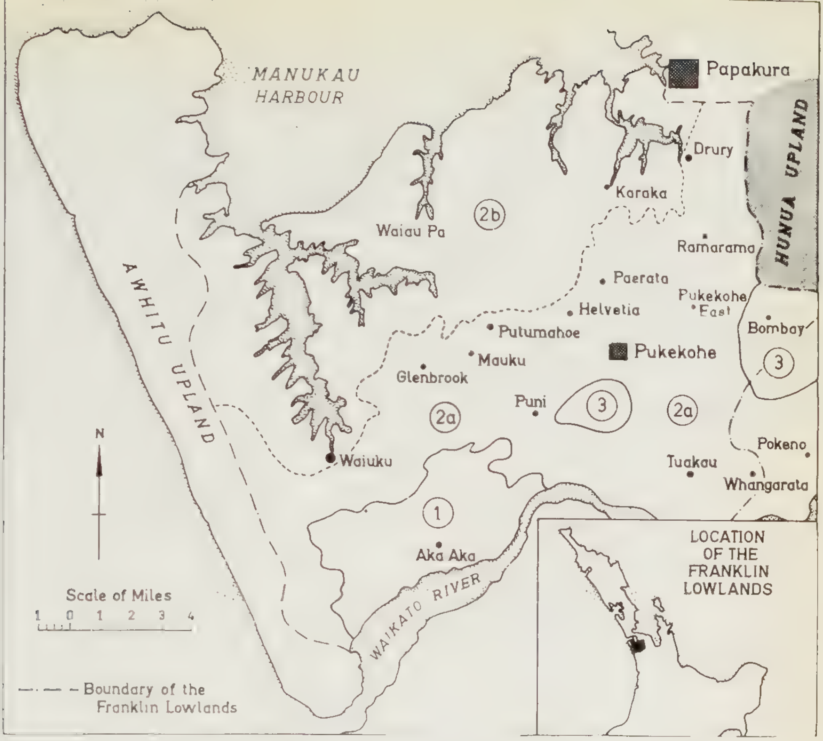

Fig. 1. Place names and generalised boundaries of soil types. 1. Drained swamp—silt loams on alluvium and peat. 2. Rolling volcanic country—a. Patumahoe clay loams, b. Loams of the Karaka complex. 3. Volcanic hills—clay loams on basaltic materials

the increasing needs of the Auckland area. Of considerably less importance are poultry farms, pig farms and horse-training stables, often run in conjunction with one of the three basic types of farming.

DAIRY FARMSTEADS

Dairy farms range from 20 to 150 acres in size. The smaller are mainly on the clay loams of the southern half of the lowlands, for on the drier, northern loams of the Karaka complex from 80 to 150 acres is the usual size. Although in all cases they are milk producers, the product may be processed for town milk supply—more especially from farms in the northern portion of the lowland—or manufactured into casein, butter or cheese. Irrespective of the nature of the end product, the essential farm buildings required to produce milk efficiently are the same. The main qualification to this is that the town supplier must, in the construction and cleanliness of his milking shed, conform rigidly to accepted standards in order to retain his licence, quite apart from the more careful farm management techniques necessary to maintain year-round production.

Siting of the house has obviously been an important consideration.

High ground which afforded good drainage as well as a pleasing view has had precedence over nearness to roads, but where a good site has offered close to the road, advantage has been taken of both. In spite of this, the orientation of the house, except in the case of some of those built during the last fifteen years, has been towards the road rather than towards the sun. Somewhere near the house, almost invariably, is a garage, for few farmers, if any, do not possess a car. In addition to the house, the garage and perhaps a detached wash house and shed, the complex of other buildings then falls into one of two broad patterns: the 'cluster' and the 'dispersed'. These two are basic and have superimposed on them two minor patterns: the farmsteads with cream stands and those with access for milk tankers. Finally, the combinations of any of these four may then be distinguished in terms of single house or multihouse units. This gives eight possible patterns.

Cluster and Dispersed Patterns

The cluster pattern may be so called because the house and buildings are relatively close together, and eighty-two percent of all dairy farms examined fell within this group (*Fig.* 3A). The milking shed and yard, or 'cowshed' as it is commonly called, containing bails, milking machines, cooling equipment and cream separator or milk vat, is seldom closer than forty yards to the house for a very obvious olfactory reason and is connected by power lines to mains electricity. Somewhat nearer to the house is a shed used for housing implements and for storage. Occasionally part of this shed may serve as a garage. Nearby is the haybarn which may be a large closed shed or an open-sided dutch barn. Often, especially with newer dairy farms, the barn is isolated, perhaps near the centre of the farm, or a second barn may be sited there.

Although cows need not be housed during the mild humid winter, occasional summer droughts and slow grass growth in late winter necessitate the making of silage and hay and the provision of fodder crops. A silage stack or pit is found somewhere on the farm. As the provision of water is of vital importance, a small pump shed is included in the complex, and usually pipes reticulate water from the shed to troughs in the various paddocks, as well as to the milking shed and dwelling house. A fowl house and dog kennel complete the picture. Pig sties are the exception rather than the rule. Farms producing milk for town supply and those supplying whole milk for cheese and casein

Fig. 2. The lowlands of Franklin County southwards from the Manukau Harbour to Pukekohe Hill in the middle distance. Beyond the Waikato River is the Raglan hill country. In the foreground is the dairy-farming country around Karaka, and the Drury Creek which gave access to the lowlands in the days of early settlement. (*Photo:* Whites Aviation)

manufacture have no skim milk to feed pigs, which are unpopular anyway in times of prosperity. Pig sties are more characteristic of dairy farmsteads in the area west of Waiuku-Glenbrook where dairy farms supply cream to the Waiuku butter factory.

Two further structures found in the dairy farmstead are situated at the road gate, and consequently may be some distance from the cluster. These are a small pen—often portable, as it is needed only seasonally—where 'bobby' calves (newly-born calves unwanted for rearing) are placed for collection by stock lorry, and a stand for holding milk or cream cans for daily collection by lorry. The latter feature is found on only seventy-nine percent of dairy farms in the area.

The dispersed type of dairy farmstead is characterised by the fact that the cowshed is situated more than a hundred yards from the house and other buildings (*Fig.* 3B). This is frequently the case on newer dairy farms or where a replacement shed has been built, the new shed being sited more centrally on the farm so that access from all paddocks is facilitated. Eighteen percent of all dairy farms show a dispersed pattern.

Evolution of Minor Patterns

Changes in methods of transport of produce can have a marked effect on the nature of the structures of the farm unit, and, though less so, on the farmstead pattern. In the area under consideration this applies particularly to the dairy farms, for until approximately thirty to thirty-five years ago dairy farmers carted their own milk or cream to the factory, loading the cans at the cowshed on to horse-drawn carts. Consequently a feature of the assemblage of buildings at that time was a stable for the horses. Then, with the introduction of factory collection, came the necessity for a roadside platform at each farm on which milk or cream cans could be placed for collection. This cream stand became a distinctive feature of the dairy-farm structures. Later, with the widespread use of tractors, the stable was converted to, or replaced by, an implement shed, and the tractor was used to haul the cans to the stand. A further major change is currently in progress in Franklin—the use of milk tankers for collection by dairy companies. Started by one company in the 1958 dairy season, and followed by a second in the 1960 season, this service is causing a notable change. The stand at the roadside is no longer necessary and has been replaced by a stainless steel vat located at one end of the cowshed, and on those farms so equipped a metalled track leads from the main road to the cowshed and is either double fenced or provided with cattle stops so that the tanker driver has no gates to open (*Fig.* 3B).

The process of change by farmers to tanker collection is gradual because it is the farmer who must stand the cost of converting his shed and providing metalled access. In the Aka Aka swamplands in particular, one third of the farmers at present prefer to transport their own milk to the factory rather than go to the expense of conversion. In this area of low-lying peat the cost of access roading capable of carrying a heavy tanker is considerable.

Effect of Tanker Collection

In September 1961 companies collecting milk for town supply intend to convert from cans to tanker; thus the process of change will be further speeded. In November 1960 seventeen percent of dairy farms were of this 'tanker-shed access way' pattern, and with conversion to tanker by town-supply farms this percentage will be more than doubled, quite apart from the gradual increase as suppliers of milk for casein and cheese change over.

As is already apparent in three or four cases, conversion to tanker collection may well alter the farmstead pattern in another way. For those farmers whose cowsheds have a low stud (eight feet high is common) vat installation requires additions in height and possibly in length to the vatroom end of the shed. For dispersed sheds, especially those far from the road, the cost of alteration, roading and fencing may well be greater than the cost of construction of a new shed and could lead to a change in shed siting to a position nearer the road.

The majority of farms are one-house units. However, the multihouse unit, representing one fifth of all dairy farm types, has a second house for either a sharemilker,[4] who may be a son, or for a hired married couple. The second house, most commonly, is less than twenty-five years old. There is, of course, almost as much variation in the actual details of the farmstead plan as there are farmsteads, and the number of ancillary buildings varies. The essential patterns, however, are represented in the eight types of layout.

The Sheep Farmstead

Dairy farms and sheep farms occupy ninety-five percent of farmland in the lowlands, but of these only one in twelve is a sheep farm. Nowhere is the land unsuitable for dairying. Sheep farming, then, is practised chiefly as a matter of choice or of tradition. Although farms can carry five or six ewes to the acre, sheep farming is economically precarious on holdings of less than 200 acres. In spite of this, there are farms of 130 acres devoted to grazing sheep. In some areas, particularly around Helvetia, Patumahoe, Glenbrook and north to the Manukau Harbour, there are farm units ranging from 200 to 500 acres, with one or two larger in size, which are used mainly for rearing fat lambs and fattening beef cattle. Many dairy farms throughout the lowlands fatten lambs in addition to dairying, but do not have any of the specialised structures of the sheep farm, their owners making arrangements with sheep-farming neighbours to use their facilities when required.

As on the dairy farm the dwelling house and garage are essential features (*Fig.* 3c). The site has been chosen similarly. The water-pump shed and dog kennels are invariably present, but the cowshed and yards of the dairy farm are replaced by the shearing shed, sheepyards and sheep dip. Except on the larger sheep farms, a shearing shed and dip are not always present, as both are very seasonal in their use, and those sheep farmers who are without rely on the goodwill of their neighbours and assist them with dipping and shearing in return for the use of the facilities. An implement and storage shed, though usually present, is not an invariable feature, as the shearing shed is often used for storage. Hay barns follow the clustered or dispersed pattern of dairy farms, and as many sheep farms keep a house cow or two, a small milking shed and a shed for household poultry are also often found. One fifth of sheep farms are multihouse units.

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[4] Sharemilking is done on three main bases: 29, 39 or 50 percent. The first two of these are covered by statutory regulation (Schedule to Sharemilking Agreements Acts, 1937 and 1951) and the last is by mutual agreement between sharemilker and owner. The essential points covered by the agreements are as follows: (i) *Twenty-nine percent.* The sharemilker milks and cares for the cows and feeds pigs. He receives 29 percent of the milk and cream cheque, and half the proceeds from calves and pigs. He provides only buckets and brushware, pays for power costs for milking and installs new inflations and milk rubbers at the end of the agreement. He pays half the cost of pigs and their feed. If he hires labour he pays the wages. If he does any general farmwork he receives an hourly wage from the owner. (ii) *Thirty-nine percent.* Essentially this is as for 29 percent except that the sharemilker is required to carry out farm maintenance work, including cultivation, and to pay half the wages of seasonal labour for hay and silage making. The sharemilker receives 39 percent of the milk and cream cheque and half the proceeds from calves and pigs. (iii) *Fifty percent.* The sharemilker provides the herd and implements, maintains the plant, and does farmwork. He receives half the total income. The details of this agreement are subject to variation.

With the rising market value for land there is a growing pressure on sheep farmers, more especially in their minds than in fact, to sell or subdivide their properties for purposes of dairying. At the same time there are cases of dairy farmers with adequate acreages converting to sheep farming with its less exacting routine. An increase in the number of town-supply licences could be a most important factor in any change to dairying, but such an increase is unlikely in the near future as existing town-supply farms are supplying a quota below their capacity.

Market-Garden Farmsteads

One farm in six in the lowland is a market garden though this type of land use occupies only one twentieth of the area. On many of the gardens the farmstead has not been designed for this specialised kind of farming. Varying in size from an acre to one hundred and forty-five acres, these farms stretch in an irregular, jawbone-shaped swathe from Patumahoe-Mauku-Puni to Bombay. Originally confined to Pukekohe Hill, the great increase in demand for vegetables over the last twenty years, both by urban areas and, until 1960, by a local canning factory, together with urban expansion on the lower slopes of the hill, has resulted in a creeping out of gardens away from the relatively frost-free slopes on the hill to land previously used for dairying. There has been an increase in the number of growers from 138 in 1955 to 200 in 1959.

This has involved the adaptation of the structures of the dairy farm to the peculiar needs of the market garden. In some cases new buildings have been added; in others some structures such as pig sties have been demolished. The dwelling house of the owner or lessee is close to the farm buildings, one of which may shelter his car or truck if a garage is absent (*Fig.* 3D). The site is not substantially different from dairy and

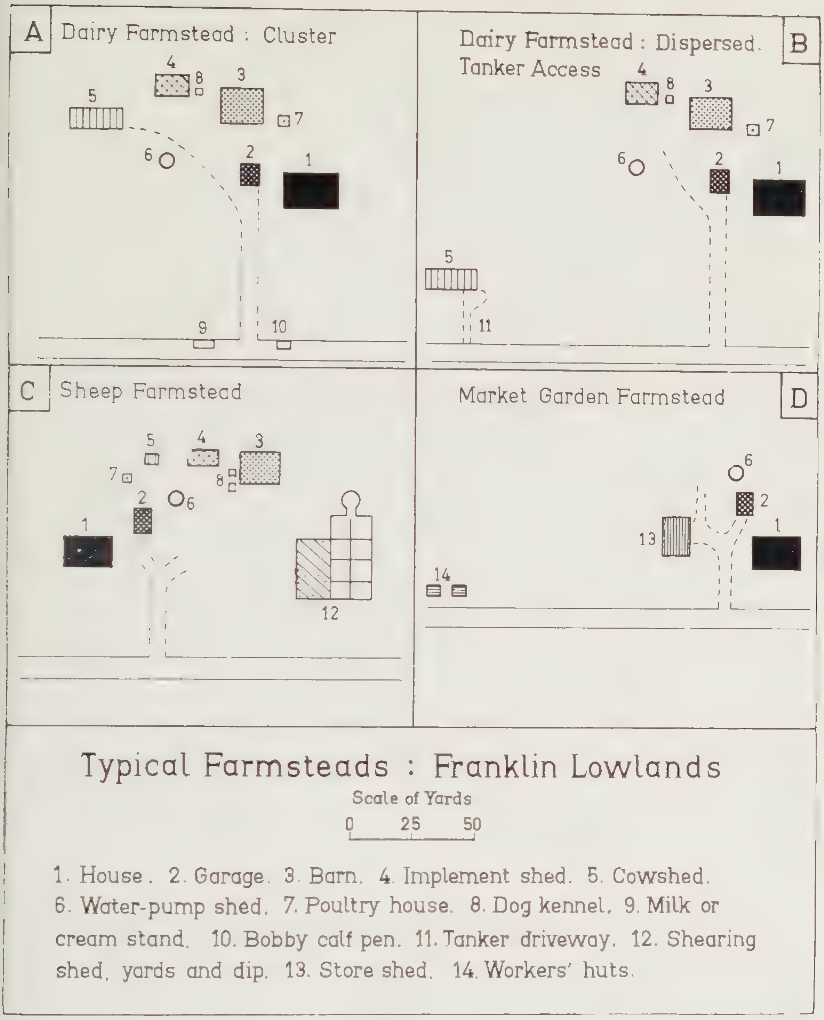
A Dairy Farmstead : Cluster
Dairy Farmstead : Dispersed. Tanker Access B
C Sheep Farmstead
Market Garden Farmstead D
Typical Farmsteads : Franklin Lowlands
Scale of Yards
0 25 50
1. House. 2. Garage. 3. Barn. 4. Implement shed. 5. Cowshed.
6. Water-pump shed. 7. Poultry house. 8. Dog kennel. 9. Milk or cream stand. 10. Bobby calf pen. 11. Tanker driveway. 12. Shearing shed, yards and dip. 13. Store shed. 14. Workers' huts.

Fig. 3. Types of farmsteads on the Franklin lowlands

sheep farms except that in the Pukekohe Hill and Bombay Hill areas it is close to the road, towards which the house faces irrespective of sun or view.

As most vegetables are trucked direct from paddock to market, packing sheds are unnecessary, although storage sheds are essential for those farmers who grow potatoes and onions, for these vegetables are often stored pending suitable prices. The shed also holds seed, sacks and fertiliser. Part of this shed, or a separate one, houses cultivating equipment. On the converted dairy farms the barn usually makes a satisfactory storage shed, but the cowshed is much less adaptable, depending on the height and the aspect of the open side. Although used for storage, it is more suitable for use as an implement shed when close to the centre of operations. A water-pump shed is usually to be found, though some farmsteads, particularly on Bombay Hill, use rainwater storage tanks, while some on Pukekohe Hill have town water.

Whereas the majority of dairy and sheep farms are family units, the market garden requires a much greater application of both permanent and casual labour. Whereas, too, the dairy and sheep farms are very largely operated by Europeans, the market garden areas are rather cosmopolitan in both management and labour. Europeans, Maoris, Chinese and Indians make up the farm personnel. Of the two hundred growers, sixty-six percent are Europeans, eighteen percent are Chinese, and sixteen percent are Indians. Indians first came to the area as workers in 1923, later leasing land on their own account. The Chinese element is relatively recent, there being only two Chinese growers in 1945.

Maoris supply the bulk of the labour. Four-fifths of these workers live on the farm in houses or huts which they rent, working usually on a contract basis. Secondary housing, then, of varying quality, is a feature of the medium-sized and large gardens. Varying from small houses or flats to unpainted wooden huts, tin shacks or dilapidated older farmhouses, this accommodation is situated some distance from the principal house, but close to a road. Stricter regulations have resulted in an improvement in the quality of workers' housing during the last two years.

At close quarters the market-garden farmstead is probably the least attractive of the three types surveyed. The well-kept ones are neat, but frequently the needs of cropping and rotation on a smallholding require that cultivation be done almost to the doors of dwellings. In these cases lawns and gardens are either minute or absent. Low-cut hedges and absence of many shade trees throughout the farm landscape lends an open and often bare appearance, whilst seasonal variation is more apparent than on the pastoral farms. In summer and autumn untidy stacks of packing cases and ramshackle workers' dwellings combine with the postharvest trash to produce a somewhat unkempt effect. In the mild winter, and in spring, there seems to be an ordered neatness, particularly from a distance, embodying a white-green-red pattern of buildings, parallel crop rows and tilled volcanic soil.

Building Materials

The availability of timber has made the building of houses of wood a tradition in New Zealand. There have been minor regional departures from this,[5] and in recent years brick and concrete have appeared more frequently. The farmhouses of Franklin are built in the timber tradition and predominantly have corrugated iron roofs. Sixty-nine percent of the rural houses were built before 1930, and these entirely of weatherboard walls and iron roofs. Of the houses built since 1930, sixteen percent are of brick with iron or tile roofing, so that only five percent of total houses are of these materials. A general air of prosperity is reflected in the well maintained appearance of the houses and the neatness of the farmyards and fences, though less so on the market gardens. White or cream walls, and red or green roofs, are the predominant colours, although pastel colours are increasing in popularity.

Yet while the houses are mainly of timber and iron, a great variety exists in the materials used for construction of the farm buildings. Combinations of timber, iron, concrete blocks, concrete, fibrolite and malthoid, singly or together, make up the structures. Any sort of classification is very complex, but in general the newer cowsheds and all the town supply cowsheds have at least the lower half of the walls and the floors constructed of concrete.

Age Structure of the Farmsteads

The frequency and distribution of farm dwellings of different ages can be used to assess developmental periods of farm settlement and land subdivision.[6] The reasons underlying settlement surges so arrived at cannot be fully assessed without recourse to historical considerations. It has been found that the density of houses of certain age groups shows a fairly high correlation with settlement periods. Very few farmhouses in the area under study are older than 1880, though settlement other than missions began in the 1840's. Huts, simple cottages and houses built in the early years have disappeared from the rural scene as the result of fire, decay, demolition and, to some extent, the Maori wars of the 'sixties. Consequently the concentration of older houses in the present rural landscape does not necessarily reflect the areas of earliest settlement.

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[5] Houses of stone and pisé have been common in the timber-poor area of Central Otago.

[6] Approximately 1,350 rural houses over the entire lowland of the Franklin County were classified in two ways according to age: (i) by the style of architecture; (ii) by interview with old-established farmers and from records where available. Five broad classes were apparent: (i) *Pre-1880;* (ii) *1880-1910*. This style is basically very distinctive but varies considerably in size and in amount of decorative detail. Often modernisation has altered the facade but not the basic design. Appearance is not always a guide to age as the original monetary outlay and the state of preservation must be considered. These include also what is known as the T-house and cottages. (iii) *1910-1930*. These range from low-cost, small, square houses to more elaborate bungalows. (iv) *1930-1940*—modern. (v) *1940-1960*—recent. Farm houses engulfed by recent urban expansion were not included in the survey, but it is considered that they would not significantly affect the conclusions.

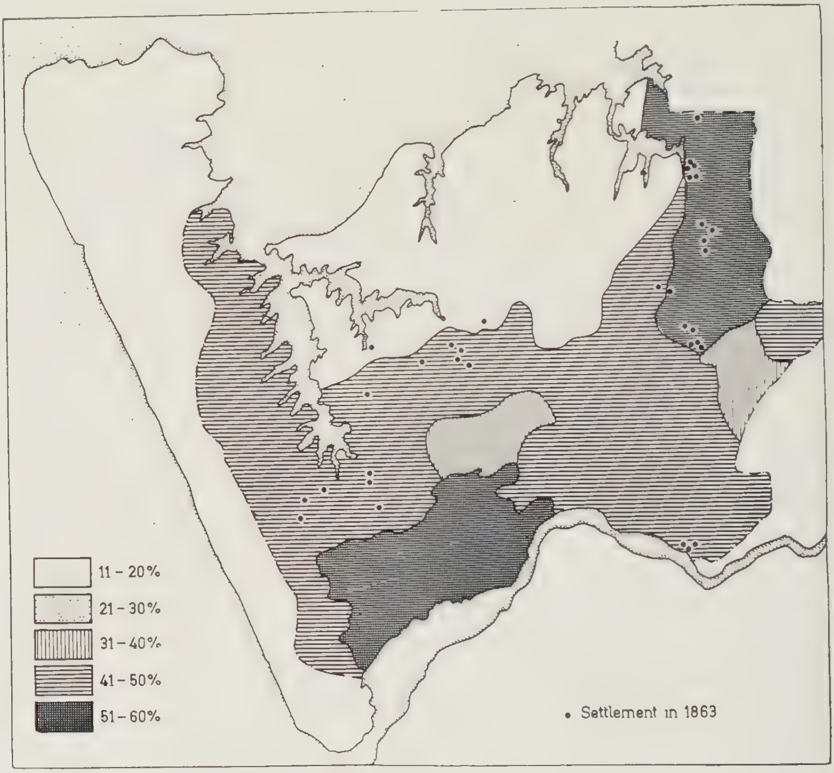

Fig. 4. Pre-1910 principal farmhouses as a percentage of all principal farmhouses in each area, in 1960, together with farm settlement in 1863

A high concentration of houses of a particular age group in an area does, however, reflect the stage at which farming in that area became profitable and secure because of legal, economic, transport, or technological reasons or of safety from war parties. Farmers thus became prosperous enough to build permanent dwellings. On the other hand, the age of public buildings such as churches and schools, for which reliable records do exist, is a useful guide to the period of initial settlement in various districts.

The Mauku church, built in 1861, has only one contemporary rural dwelling between it and Waiuku. Though the first settlers in the Mauku–Glenbrook area arrived in the 1840's, it was not till the late 'fifties and 'sixties that settlement began in numbers. Even then the Maori wars hindered expansion, as the bullet-scarred church which was used as a sanctuary during the period still bears testimony. The map of settlement in 1863 (*Fig.* 4) shows a concentration in this area. The Anglican church at Drury, dedicated in 1863, and the church at Pukekohe East built in the same year, lie in an area with a high concentration of from fifty to sixty percent of older houses and a high concentration of settlers in 1863. An even older church (1856) and a school (1857) at Drury were both later burned down and replaced. Settlement quite obviously would have preceded such public buildings. Drury and Runciman were first settled between 1845 and 1850, and Pukekohe

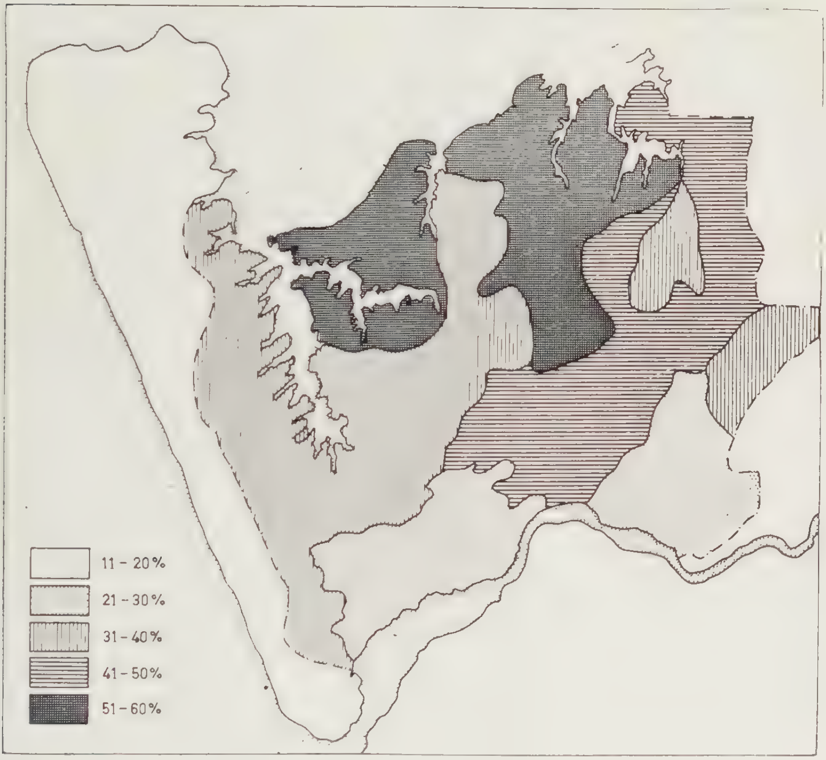

Fig. 5. Principal farmhouses of the 1910–1930 period as a percentage of all principal farmhouses in each area in 1960

East in the early 1850's. Similarly the small rural school at Puni (1882) gives evidence of longer-established farm settlement than the school at Aka Aka (1906) in the swamplands and that at Karaka (1903) in the north of the lowland. Karaka lies in the area with the lowest concentration (from ten to twenty percent) of older houses, and apart from the two early settlers on the coast (*Fig.* 4) had to await technological advance for development of the fern and scrub land on its dry soils.

In general, house-age concentration presents a fairly accurate picture of historical farm settlement. In Franklin, however, the Aka Aka swamplands of the southwest are an exception to the general pattern. Showing the highest concentration (54 percent) of houses of the 1880-1910 type, the impression gained is one of old settlement, but these older houses were not in fact built until after drainage was commenced in 1895. The high percentage of older types results from a fairly concentrated period of settlement on farms not large enough for much subsequent subdivision.

Apart from the apparent anomaly of the swamplands—though it must be remembered that it was not till the turn of the century that dairying began to flourish in Franklin—the map (*Fig.* 4) brings out a distinct correlation between house types and historical and physical factors of settlement. Early settlement depended primarily on access. The area of Awhitu-Waiuku-Glenbrook-Patumahoe-Mauku was relatively close to the arms of the Manukau Harbour and was thus easily accessible by boat from Onehunga and, thereby, Auckland. Drury was doubly favoured by track and road to Auckland and by the Drury Creek to the Manukau. Settlers at Ramarama and Pukekohe East could avail themselves of these facilities at Drury.

ADVENT OF ROADS

With the establishment of the Provincial Council in the early 'fifties roading became of greater importance to settlers, and the South Road opened up possibilities from Drury to Bombay and the Waikato River. The advantages of the road were partly offset by the outbreak in the next decade of the Maori wars, which deterred settlement, though military camps at Drury and Tuakau gave some security. Tuakau was favoured by access to the river landing on the Waikato. The establishment of farm settlement schemes for both civilians and soldiers in the Waiuku area and Drury was a further factor in raising the concentration of older houses, although not all the land so allotted was actually occupied and built on. The Pukekohe area, as distinct from Pukekohe East but including Pukekohe Hill, remained as a Maori reserve until the 1870's, when settlement was further hastened by the construction of the railway.

Moreover, all these areas were largely in bush which, when cleared, yielded reasonably fertile farmland. The boundary between these earlier-settled portions with more than thirty percent of pre-1910 houses, and in which the few pre-1880 houses occur, and the northern part with its much lower proportion of earlier houses, coincides fairly closely with the northern bush margin and the southern limit of the dry soils of the Karaka complex originally covered in fern and scrub (*Figs.* 1 and 4). This last area was mostly held in large estates on which, from the 1880's until the early part of the century, sheep were grazed and oats and grass seed grown. It is here, too, that the larger sheep farms are still to be found. Over the entire lowland area the proportion of farmhouses built during the pre-1910 period and still occupied is a little more than one third the total number of the farm dwellings (*Fig.* 7).

ADVENT OF NEW TECHNIQUES

A slightly more important period of settlement in the lowland, as evidenced by house ages, came between 1910 and 1930, more especially after the first World War (*Fig.* 5). Although spurred by land subdivision for settlement of soldiers after the war, the expansion of this period was based on scientific advance in terms of cream separation at home, topdressing and better farming techniques, and it owed much to the basic groundwork of farm settlement laid in the earlier period. During these years forty-one percent of the principal farmhouses were built.[7] The greatest relative growth was in the area north of Paerata–Glenbrook on the Karaka soils, where now fifty-five percent of the houses are of this period. A notable exception is the corridor north of Patumahoe, much still in sheep farms, but showing high post-1940 development. In the older settled parts the overall proportion of homes built between 1910 and 1930 is somewhat less (35 percent) than for the earlier period, though there are significant regional differences. The swamp lands of Aka Aka have only twenty-three percent, while the country bordering the Great South Road shows a density almost equal to that of houses built between 1880 and 1910.

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[7] The 'principal' house is the farmhouse on single-house farms and the older house in the case of multihouse farms.

The 1930's, as one would expect, show little building activity as a consequence of the years of economic depression. Although eight percent of the principal houses were constructed in this decade, the majority were built in the immediate prewar years, which in this respect may be considered as the early phase of the renewed expansion after the second World War. From then until 1960 the third major, though less outstanding, surge in farm construction, subdivision, settlement and production is apparent from the evidence of farmhouse types (*Fig.* 6). Thirteen percent of the principal houses and twenty-two percent of all houses fall into this category. The new building has been fairly uniform throughout the lowlands, the only significant variations being the greater activity in the Waiau Pa–Karaka area and from Pukekohe East to Tuakau, and the less significant

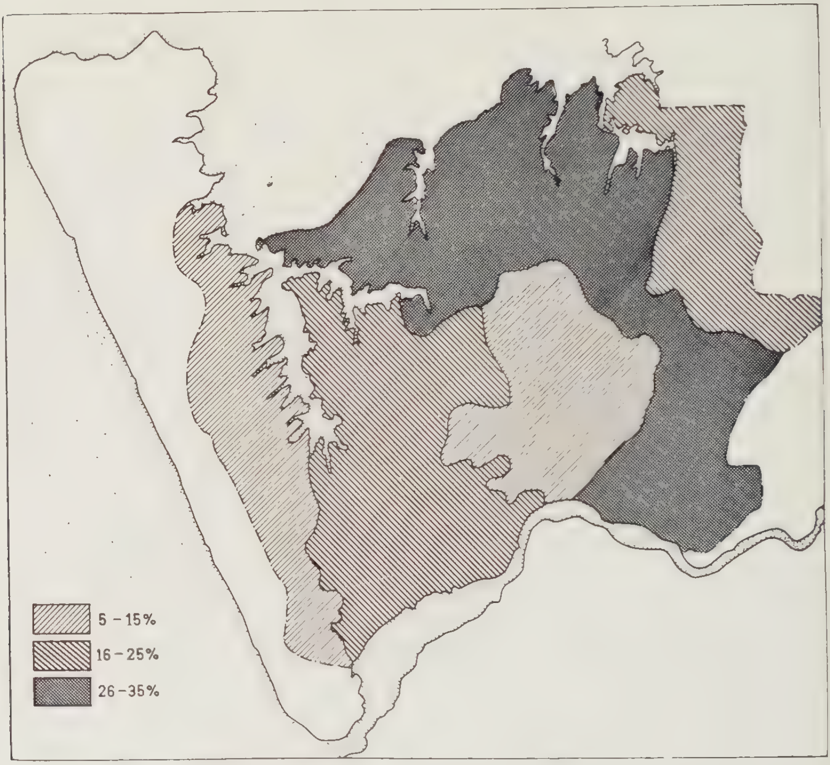

Fig. 6. All post-1940 houses on farms as a percentage of all houses on farms in each area in 1960 building activity around Puni–Pukekohe–Helvetia and west of Waiuku.

MULTIHOUSE FARM UNITS

One farm in five throughout the lowlands has more than one house.[8] The use of these on dairy farms has already been pointed out, though the larger sheep farms are usually multihouse units. Irrespective of which house the owner lives in, the older dwelling is the significant one from the point of view of settlement. The newer houses are noteworthy as an indication of increased prosperity and intensification of land use, though not necessarily of an increased application of

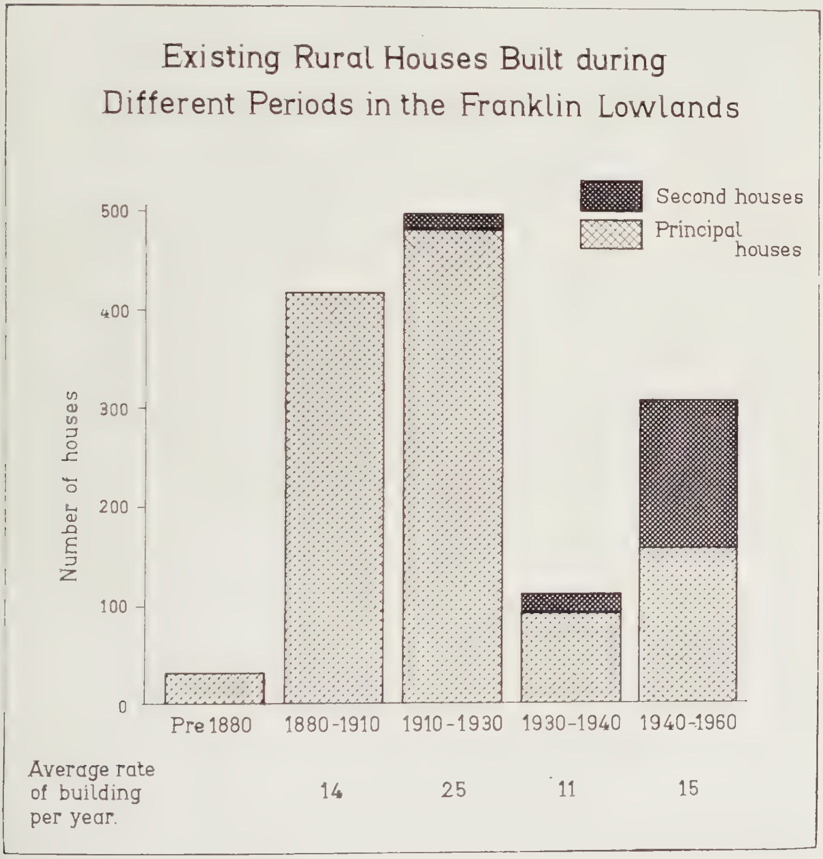

Fig. 7. Numbers of existing rural houses built at different periods labour. Some regional variation in multihouse units exists, there being as few as one in ten west of Waiuku and in the Aka Aka swamplands, and from one in five to one in 3.5 north of a line from Ramarama to Paerata and Mauku. This last area is an important source of town-milk supply which requires constant year-round milking. Of the second houses on all farms, four-fifths have been erected since 1940, and approximately eleven percent were built in the late 1930's (*Fig.* 7).

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[8] Market gardens are not included in this assessment as they possess an extremely heterogeneous collection of additional buildings.

The relatively recent development of the multihouse farm unit reflects not only greater prosperity but the rise in stock-carrying capacity consequent upon increased topdressing, the use of improved strains of pasture plants, and the introduction of better farm-management techniques, as well as changes in farm end-products following the growing importance of Franklin County as a source of liquid milk, vegetables and fat stock for metropolitan Auckland, and in the attitudes of rural people to leisure and holiday activities. On dairy farms and, in particular, on town-supply farms, seven-day week, year-round milking has little appeal. With the multihouse unit, owner and sharemilker, owner and hired farmworker, or sharemilker and hired farm worker, can alternate weekend milking and holidays and so avail themselves of leisure activities which their relatively high standard of living enables them to enjoy. In addition, many who began farming during the important settlement surge of 1910-1930 have now reached an age when they prefer to delegate responsibility to a son, or to employ responsible married labour or a sharemilker, while they themselves merely have an interest in the running of the farm.

CHANGING PATTERN

By North Island standards the lowlands of Franklin County constitute an area of old-established farm settlement. But it is far from static, and the evidence of change is very apparent in the still-evolving patterns of farmsteads and farmland. Change in the present period is as great as at any previous time, and is proceeding apace. It is apparent from week to week in every new cowshed, new tanker driveway, or additional house. When the tanker service is fully utilised within the next two or three years the patterns in the dairy farmsteads should again have some stability for a period. On the other hand there are indications that the market-garden farmstead will become increasingly a feature of the Franklin lowlands and so impart that element of change and progress which has always characterised the region.

SOME MEASURES OF THE DISTRIBUTION OF MANUFACTURING APPLIED TO NEW ZEALAND

G. J. R. LINGE

MUCH of the rethinking that has been taking place during the last few years about the industrial future of New Zealand[1] has been centred on the kinds of manufacturing that ought, or ought not, to be encouraged. However, a question that should be considered at the same time is *where* additional employment in factories is likely to take place. The economic and social implications of industrial expansion are not at all obvious, and a wide range of research must be undertaken in order that the resources of the community can be used to the greatest advantage. Investigations into the locational aspects of industrial development could be of considerable assistance to the central government and to the planning and promotional programmes of territorial and *ad hoc* local authorities. Unfortunately in New Zealand few enquiries have been made into the spatial variations in the growth of individual industries, into the changes that may occur in the industrial structure of various regions in the dominion, and whether for economic or social reasons there should be a national policy towards the location of new manufacturing.

This paper describes and illustrates three measures of the distribution of manufacturing in New Zealand, the results of which may lead to preliminary thinking on some of the questions raised above.[2] These are: (i) the *coefficient of localisation;* (ii) the *index of economic diversification;* and (iii) the *positive refined index of diversification*. The basic data used for each of these measurements were drawn from unpublished returns of the factory registration survey carried out by the Department of Labour and Employment in 1956. Employment information was available for thirty-six industry groups in each of the twenty-five employment districts into which New Zealand is divided (*Fig.* 1).

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[1] See, for instance, W. B. Sutch: *The Next Two Decades of Manufacturing in New Zealand*, paper read to Section G, A.N.Z.A.A.S. Conference, Dunedin, January 1957; and also *Background Papers* for the New Zealand Industrial Conference, Wellington, June 1960.

[2] Other measurements of manufacturing in New Zealand have been described elsewhere. See G. J. R. Linge: 'The Location of Manufacturing in New Zealand', *N.Z. Geographer*, Vol. 13, No. 1, April 1957, pp. 12-18, for a discussion of 'location factors (quotients)'; and *idem*, 'The Concentration and Dispersion of Manufacturing in New Zealand', *Econ. Geog.*, Vol. 36, No. 4, October 1960, pp. 326-343, for a multiple-criteria technique which gives ratings of 'magnitude' and 'intensity' for each employment district in New Zealand. This latter paper also interprets the distribution of manufacturing more fully than has been attempted here.

INDUSTRIES DISPERSED OR LOCALISED

The New Zealand Government has no stated policy towards the location of manufacturing nor is any 'indirect' control exercised through the operations of, for instance, the Capital Issues Committee. Yet frequently concern has been expressed not only about the future of the three main urban areas of Auckland, Christchurch and Wellington-Hutt, but also about that of Dunedin and the smaller, secondary towns. On the one hand it has been suggested that too much of the productive resources of the dominion is being concentrated into the chief centres of population, with a consequent overdemand for services and utilities of all kinds. On the other hand some secondary towns are not developing rapidly enough to provide employment opportunities for children now leaving school; consequently services and utilities are not being used to full capacity and young people are forced to go to (and, no doubt, are strongly attracted by) the 'bright lights' of the great wens—Auckland, Wellington, or Christchurch.

There are, of course, strong practical and theoretical grounds for establishing relatively 'foot-loose' manufacturing at large centres of population, a fact well demonstrated by the pull exerted by London despite the controls exercised by the British Government after the second World War.[3] There is no space here to argue the advantages and disadvantages of metropolitan concentration: indeed this would be presumptuous in the light of recent statements by Florence and Ratcliffe.[4] There are, however, two factors in New Zealand which add weight to Florence's conclusion that concentration is not always advantageous. First, the extensive rather than intensive use made of land in New Zealand cities increases the costs involved in overcoming 'the friction of distance'. It is useful to bear in mind in this connection that the urbanised part of Auckland, with a population of about 400,000, occupies twice the area of, say, Bristol in England, with a population of about 440,000. Secondly, the lightness and service nature of much of the manufacturing carried on and the generally small size of the productive units suggests that not all factories need, at least on

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[3] M. J. Wise: 'The Role of London in the Industrial Geography of Great Britain', *Geography*, Vol. 41, Part 4, November 1956, pp. 219-232.

[4] P. Sargant Florence: 'Economic Efficiency in the Metropolis', Chapter 6, and Richard U. Ratcliffe: 'Efficiency and the Location of Urban Activities', Chapter 5, in Robert Moore Fisher (Ed.): *The Metropolis in Modern Life*, New York, 1955.

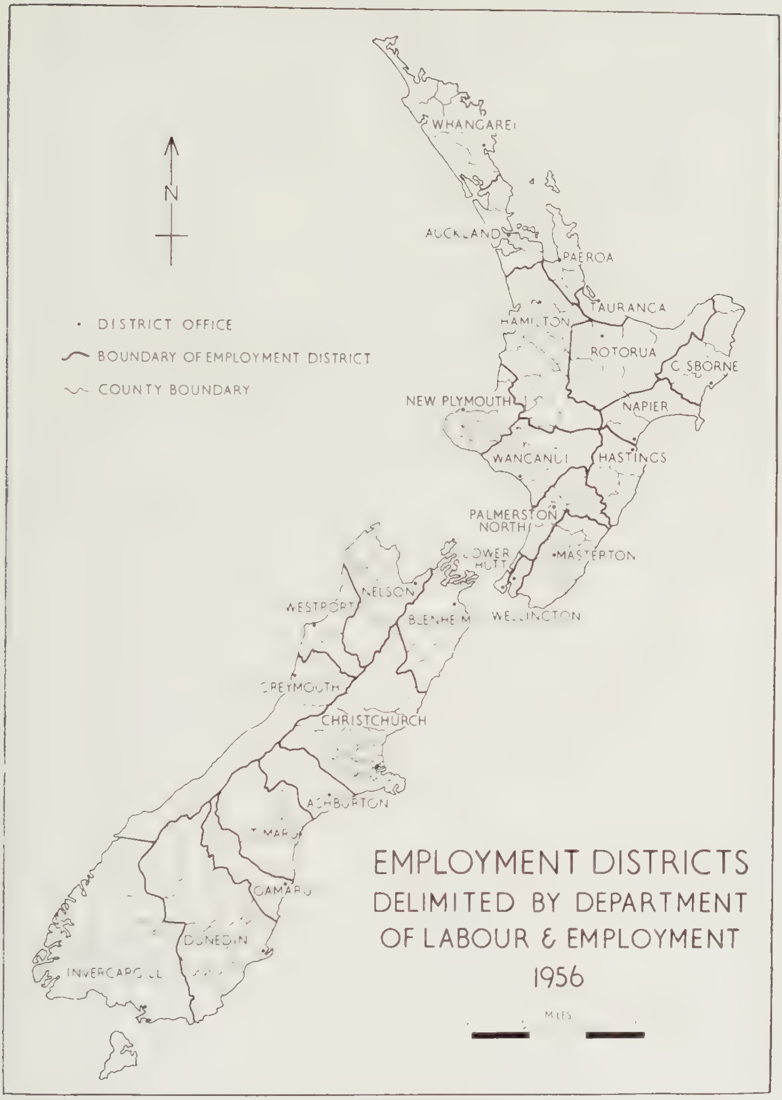

Fig. 1. Employment districts of New Zealand as defined by the Department of Labour and Employment, 1956

economic grounds, have been set up at the main urban areas. This view has been suggested by fieldwork carried out by the writer in New Zealand between 1955 and 1959.

The Coefficient of Localisation

One technique which can be used to give some indication of the industries which tend to be dispersed and those which tend to be localised is the *coefficient of localisation*, a measure proposed by Florence and Wensley in 1937.[5] A method familiar to workers in the field of

TABLE I

METHOD OF DETERMINING THE COEFFICIENT OF LOCALISATION: ENGINEERING PRODUCTS

Employment Districts	*Percentage of the Total Labour Force in Each Employment District*	*Percentage of Workers in Engineering Products in Each Employment District*	*Divergences plus or minus*
Auckland ..	21.3	36.9	+15.6
Whangarei ..	3.4	1.2	—2.2
Hamilton ..	7.3	3.3	—4.0
Paeroa	1.5	1.5	0.0
Tauranga ..	1.2	0.4	—0.8
Rotorua	3.1	0.3	—2.8
Gisborne ..	1.8	0.4	—1.4
Napier	1.8	1.0	—0.8
Hastings	1.9	0.8	—1.1
New Plymouth	3.7	2.9	—0.8
Wanganui ..	3.0	1.3	—1.7
Palmerston North	4.2	3.3	—0.9
Masterton ..	1.7	1.0	—0.7
Lower Hutt ..	3.0	5.4	+2.4
Wellington ..	10.1	9.6	—0.5
Blenheim ..	1.1	0.5	—0.6
Nelson	1.9	0.7	—1.2
Westport ..	0.5	0.1	—0.4
Greymouth ..	1.3	0.3	—1.0
Christchurch ..	11.2	16.8	+5.6
Ashburton ..	1.0	0.4	—0.6
Timaru	2.2	1.0	—1.2
Oamaru ..	0.9	0.6	—0.3
Dunedin ..	7.0	8.3	+1.3
Invercargill ..	3.9	2.0	—1.9
	100.0	100.0	+24.9/—24.9

Coefficient of Localisation for Engineering Products: $\frac{24.9}{100} = 0.25$

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[5] P. Sargant Florence: 'Economic Research and Industrial Policy', *Economic Journal*, December 1937, pp. 621-641. See also P. E. P.: *Report on the Location of Industry in Great Britain*, 1939 pp. 291-293.

industrial location, the coefficient of localisation has not, as far as is known, been applied previously to New Zealand manufacturing. It is calculated (as illustrated in Table I) by comparing the percentage distribution of the labour force in a given industry between the employment districts with the percentage distribution of the total labour force between these districts. The coefficient itself is obtained by dividing the positive total deviation by 100 which gives a result in each case lying within the range 0 to 1. Clearly, the lower the coefficient, the less the divergence between the distribution of workers in a given industry and that of all employed workers. The coefficients for the thirty-six groups of New Zealand manufacturing are listed in Table II.

TABLE II

COEFFICIENTS OF LOCALISATION: INDUSTRY GROUPS IN NEW ZEALAND

Bread	0.07	Footwear	0.43
Jewellery and Instruments	0.21	Grain Milling	0.43
Builders' Woodwork	0.21	Sawmilling	0.43
Beverages	0.21	Other Textile Products	0.44
Furniture	0.22	Paper and Paper Products	0.45
Lime and Cement	0.23	Pottery and Glass	0.46
Meat Freezing	0.24	Motor Vehicle Assembly	0.46
Bricks and Tiles	0.24	Fruit and Vegetable Preserving	0.46
Engineering Products	0.25	Other Manufacturing	0.47
Printing	0.25	Flax, Rope and Twine	0.48
Clothing	0.27	Boatbuilding	0.49
Other Foodstuffs	0.32	Dairy Produce Processing	0.49
Chemicals	0.33	Other Textile Articles	0.50
Electrical Engineering	0.33	Biscuit Baking	0.54
Tanning	0.36	Rubber Goods	0.58
Knitted Wear and Hosiery	0.38	Sugar and Confectionery	0.62
Leather Goods	0.39	Woollen Milling	0.64
Other Wood Products	0.40	Tobacco Manufactures	0.73

In the absence of many 'heavy' or 'basic' manufacturing activities it is true to say that the great majority of the industrial enterprises in New Zealand make complete articles for direct sale to the ultimate consumer. An analysis of income-tax returns by taxation districts[6] suggests that there is little regional variation in incomes per head of employed workers, and it can be supposed, therefore, that the distribution of the total labour force between the employment districts gives a reasonable view of the distribution of ultimate consumers.

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[6] Details for 18 tax districts are given in the table 'Incomes of Individuals: Income Year, 1954–55—District Totals' in *New Zealand: Statistics of Incomes and Income Tax, 1954–55*.

As might be supposed, those industries which, by necessity or convenience, are spatially associated with the ultimate consumer are seen in Table II to have low coefficients of localisation. Some serve people in a direct and personal way—jewellery and watch making (repairing), and furniture making, and some produce perishable foodstuffs, such as bread and ice cream, or ephemeral goods, such as newspapers. Other industries tend to be located near the ultimate consumer because their products have a low value per unit of weight, such as bricks, tiles, baked stoneware and builders' woodwork, or add bulk or weight, such as the manufacture of beverages, and hence have relatively high transport costs. As might also be supposed, those industries which have relatively few units of production in New Zealand, which rely wholly or very largely on imported raw materials, and which tend to be concentrated at the main urban areas, have high coefficients. This is the case with the manufacture of tobacco products, rubber goods, woollens, and sugar and confectionery products, and with biscuit making, all of which have coefficients greater than 0.50.

Care must, of course, be taken in interpreting these results. Some industries which rely on raw materials from rural areas, as, for example, sawmills and dairy factories, would not be expected to have a close correlation with the total labour force—the frame of reference adopted here. Or again, the low coefficient shown by the meat-freezing industry is partly the reflection of the wide distribution of meatworks throughout the country and partly of the fact that these works tend to be located near the coast within easy reach of ports, which are also usually moderate to large population centres. There is the problem, too, that the division of all manufacturing activities into only thirty-six groups (the greatest number for which geographical information is available) causes some groups to be somewhat heterogeneous; 'chemicals', for instance, includes not only pharmaceutical, veterinary and industrial preparations, but also agricultural supplies such as fertilisers. However, some groups—bread baking, biscuit making, motor-vehicle assembly and woollen milling, for example—are fairly clearly defined and homogeneous in content. The calculation of the coefficients of localisation for New Zealand industries, even bearing in mind these difficulties, does throw light on an aspect of the contemporary distribution of manufacturing which may be of assistance in assessing future trends.

DISTRICTS INDUSTRIALLY DIVERSIFIED OR CONCENTRATED

Another way of examining the geographical distribution of manufacturing is to analyse not individual industries but the overall industrial structure of individual local areas. One of the main characteristics which helps to determine the vitality and health of a local economy and its susceptibility to fluctuations in the level of business activity in the nation as a whole is the extent to which its manufacturing activities are diversified.

Two measures of diversification have been applied to manufacturing in the New Zealand employment districts. The districts have been purposely used in this present analysis because it is believed from empirical observation that these areas represent the nearest approach in New Zealand to 'local economies' for which suitable statistics are available. Furthermore, each of these areas has only one main town within its boundaries and this acts as the economic, social and community focus of the whole district.

The techniques illustrated here both make an assumption about the standard or normal position, and then measure the divergence from this position. The first, the *index of economic diversification*, assumes this norm to be an equal proportion of persons employed in each of the industries in a district, while the second, the *positive refined index of diversification*, assumes this norm to be a similar pattern of employment in each district, as is actually the case in the country as a whole.

THE INDEX OF ECONOMIC DIVERSIFICATION

The index of economic diversification was derived by Rapkin, Winnick and Blank for a research monograph prepared by the Institute of Urban Land Use and Housing Studies of Columbia University.[7] The index is particularly interesting because it takes into account not only the distribution of employment between industries but also the number of industries actually present in a district. As the publication in which this measure was originally proposed may not be generally available, it is useful to set out briefly the method by which Rapkin and his associates derived the equation for the index. One expression of the divergence between the actual position and the assumed normal position is the sum of the squared deviations from the mean. To avoid the difficulties of comparison between districts having different absolute totals of workers in manufacturing, the deviations are calculated from the mean percentage which, for New Zealand, using thirty-six industry groups, is 100/36 or 2.7778. The index is obtained by relating the actual sum of the squares of the deviations to the maximum possible value of the squared deviations.

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[7] C. Rapkin, L. Winnick and David M. Blank: *Housing Market Analysis: A Study of Theory and Methods*, New York, 1953, pp. 88–90.

The general sum of the squared deviations is

$$\sum_{1}^{N}(X_i)^2 - \frac{100^2}{N}$$

where X_i is the percentage of employment in industry i, and N is the total number of industries located in the area. The maximum value of this function occurs when the values of X_i fall at the extremes of the distribution; $X_i = 0$ is not possible because if there were no employees in an industry group it will not be taken into account, and similarly if $X = 100$ there is no dispersion. If out of N industry groups one value of X_i *approaches* 100, however, then the remaining group (N – 1) must each *approach* 0 if the percentages of employment in the industry groups are to total 100. On this assumption the maximum value of the general function is then $100^2 - \frac{100^2}{N}$ which can also be expressed as $100^2 \left(1 - \frac{1}{N}\right)$. Relating this maximum value to the general sum of the squared deviations gives

$$\frac{\sum_{1}^{N} (X_i)^2 - \frac{100^2}{N}}{100^2 \left(1 - \frac{1}{N}\right)}$$

, or more succinctly (when multiplied by N)

$$\frac{N \ \Sigma (X_i)^2 - 100^2}{100^2 \ (N - 1)}$$

. When all the industries have the average proportion of employees (2.7778 percent) this expression can be seen by substitution to equal 0, but when all employees are concentrated in a single industry it equals 1.

Since Rapkin and his associates sought a measure of the diffusion of employment they required the higher values of the index to indicate the greatest degrees of diversification, and this was achieved by subtracting this expression from 1. It may then be set out as

$$1 - \frac{N \Sigma (X_i)^2 - 100^2}{100^2 (N-1)}, \text{ or stated alternatively as}$$

$$\left[\frac{N}{N-1}\right] \left[1 - \frac{\Sigma (X_i)^2}{100^2}\right]$$

The calculation so far has been concerned only with the distribution of employment, and if the above expression was used as the index it would not reflect the influence of the number of industries on diversification. For example, the same numerical index would result if there were 10 industries in an area each employing 10 percent of the workforce, or two industries each employing 50 percent of the workforce.

However, by dropping the factor $\frac{N}{N-1}$ and making the index of economic diversification $1 - \frac{\Sigma (X_i)^2}{100^2}$ the number of industries in a district is made to have a direct bearing on the maximum value of the index. Thus, in an area with two industries the index cannot exceed $1 - \frac{50^2 + 50^2}{100^2}$, or 0.50, even if there was complete diffusion of employment. But in an area where there are 10 industries the maximum value of the index can be as high as

$$1 - \frac{10^2 + 10^2 \ldots \text{etc.}}{100^2}, \text{ or } 0.90$$

Although, as has already been shown, the maximum value of the index depends on the absolute number of industries in a district this does not influence the lower limit of the index which is always 0.

The results of the application of this technique to the New Zealand employment districts are set out in Table III. For each district the possible range of the index, based on the number of industries actually present, and the actual result obtained are indicated. The districts which show the least diffusion of employment amongst their particular selection of industries are Rotorua, Westport and Hastings, while at the other extreme the indices for Christchurch, Napier, Dunedin and Auckland all approach the upper limits of their possible ranges. The calculations made in the same way for New Zealand as a whole give the result of 0.935 in a possible range of 0–0.972, the highest index

TABLE III

Index of Economic Diversification Computed for Manufacturing Industries in New Zealand

Employment Districts	*Number of Industrial Groups*	*Possible Range of Index*	*Actual Index*
Rotorua	21	0–0.952	0.735
Westport	17	0–0.941	0.744
Hastings	29	0–0.965	0.772
Invercargill	33	0–0.970	0.824
Gisborne	27	0–0.962	0.832
Oamaru	21	0–0.952	0.835
Greymouth	20	0–0.950	0.835
Paeroa	20	0–0.950	0.839
Ashburton	18	0–0.944	0.856
Masterton	21	0–0.952	0.857
Wanganui	32	0–0.969	0.868
New Plymouth	26	0–0.961	0.868
Blenheim	27	0–0.962	0.882
Lower Hutt	30	0–0.967	0.883
Nelson	28	0–0.963	0.883
Hamilton	28	0–0.963	0.884
Timaru	30	0–0.967	0.889
Whangarei	25	0–0.960	0.894
Wellington	33	0–0.970	0.898
Palmerston North	34	0–0.971	0.905
Tauranga	26	0–0.961	0.906
Auckland	36	0–0.972	0.918
Dunedin	33	0–0.970	0.926
Napier	29	0–0.965	0.927
Christchurch	34	0–0.971	0.932
New Zealand	36	0–0.972	0.935

recorded, and this draws attention to the diversified nature of manufacturing in the dominion as a whole in the sense of approaching equality in the proportion employed in each of the industry groups.

THE POSITIVE REFINED INDEX OF DIVERSIFICATION

The second measure of the degree of diffusion or concentration of employment in manufacturing in each of the New Zealand employment districts, the *positive refined index of diversification* takes as its norm or standard the actual distribution of workers between the thirty-six industry groups in the dominion as a whole. The technique used here is an adaptation of that suggested by Rodgers[8] which is, in turn, a modification of the methods suggested by other writers.[9]

TABLE IV

METHOD OF CALCULATION OF CRUDE INDEX OF DIVERSIFICATION: AUCKLAND EMPLOYMENT DISTRICT

Ranked Percentages	*Progressive Totals*	*Ranked Percentages*	*Progressive Totals*
17.43	17.43	1.37	86.42
16.53	33.96	1.34	87.76
9.37	43.33	1.29	89.05
5.90	49.23	1.11	90.16
4.73	53.96	1.09	91.25
3.82	57.78	1.09	92.34
3.76	61.54	1.04	93.38
3.26	64.80	0.92	94.30
2.98	67.78	0.92	95.22
2.75	70.53	0.88	96.10
2.52	73.05	0.88	96.98
2.28	75.33	0.76	97.74
1.79	77.12	0.69	98.43
1.76	78.88	0.56	98.99
1.69	80.57	0.33	99.32
1.56	82.13	0.30	99.62
1.48	83.61	0.20	99.82
1.44	85.05	0.18	100.00

Crude Index of Diversification : 2862.96

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[8] A. Rodgers: 'Some Aspects of Industrial Diversification in the United States', *Econ. Geog.*, Vol. 33, No. 1, January 1957, pp. 16–30.

[9] Edgar M. Hoover Jr.: 'The Measurement of Industrial Localization', *Review of Economic Statistics*, Vol. 18, No. 4, November 1936, pp. 162–171; and R. C. Tress: 'Unemployment and the Diversification of Industry', *The Manchester School*, Vol. 9, No. 1, 1938, pp. 140–152.

To derive the index the percentages of employment in the industries in a district are computed, ranked in descending order, and a series of progressive totals obtained which, when totalled, give a crude index. Table IV illustrates the method for calculating the crude index of diversification for the Auckland employment district.

With thirty-six industry groups the crude index for least diversity (obtained in the same way)—that is, the most specialised area with one industry group employing all factory workers—is 3,600, whereas the crude index for complete diffusion (each industry group employing an equal number of workers) is 1,854.

The unrefined indices for the districts are not adequate as they stand, however, because they give no indication of the relative degree of diversity. A norm or base level is required, and this is provided in Rodgers's technique by reference to the distribution of employment between industry groups in the country as a whole. Hence

$$\begin{array}{c}\text{Refined Index for each}\\ \text{employment district}\end{array} = \frac{\begin{array}{c}\text{Actual Crude Index minus Crude Index}\\ \text{for all employment districts}\end{array}}{\begin{array}{c}\text{Crude Index for Least Diversity minus}\\ \text{Crude Index for all employment}\\ \text{districts}\end{array}}$$

Thus, for the Auckland district

$$\text{Refined Index} = \frac{2863 - 2758}{3600 - 2758} = 0.124$$

Here a further modification to Rodgers's method has been made. As it stands the refined index is a negative one, that is the higher values represent least diversification. It would seem preferable to emphasise this as a positive measure of diversification by arranging that the higher values represent maximum diversity. This can be done by subtracting the refined index from 1, so that in the case of the Auckland district the positive refined index becomes $1 - 0.124$ or 0.876. The indices calculated for each of the twenty-five New Zealand employment districts are set out in Table V.

It was demonstrated during the calculation of the index of economic diversification that New Zealand as a whole has a diffused pattern of employment in manufacturing. Accordingly it would be expected that districts which have a high ranking by the first method would also have a high ranking by the second. This is, in fact, the case with the highest rankings representing the greatest degrees of diversification, which are achieved by the same four districts, namely, Christchurch, Auckland, Dunedin and Napier. Most of the industrial activities in the first three of these districts are concentrated in the main urban areas after which the districts are named. It is perhaps not surprising that a fairly wide range of manufacturing would have grown up at these large centres of population, but it is revealing that Wellington, the capital and the only other major centre of population in New Zealand, has a much less diversified structure. Perhaps the reason for this is the central position of Wellington as a distribution point for the products of national industries—that is, those industries which are established in a limited number of areas but serve the national market.[10] It is not without interest, too, that the Napier district appears so high in terms of both indices of diversification. Both measures also draw attention to the lack of diversity in industrial employment in some districts, particularly Westport and Rotorua.

TABLE V

POSITIVE REFINED INDEX OF DIVERSIFICATION
COMPUTED FOR MANUFACTURING INDUSTRIES
IN TWENTY-FIVE EMPLOYMENT DISTRICTS

Employment District	*Positive Refined Index*	*Employment District*	*Positive Refined Index*
Rotorua	271	Tauranga	555
Oamaru	350	Gisborne	555
Ashburton	365	Lower Hutt	606
Westport	365	Wanganui	613
Paeroa	367	Wellington	618
Hastings	395	Palmerston North	680
New Plymouth	404	Nelson	696
Greymouth	410	Timaru	708
Masterton	452	Napier	714
Hamilton	487	Dunedin	815
Whangarei	499	Auckland	876
Blenheim	514	Christchurch	891
Invercargill	519		

The results set out in Tables II, III and V do provide broad answers to some of the questions raised from time to time about New Zealand manufacturing. On the one hand, confirmation seems to be given to the notion that the Auckland and Christchurch districts (in effect also the urban areas of the same names) have broad bases of industrial activity, and that Rotorua and Westport areas tend to be narrowly specialised. On the other hand, the unexpectedly low diffusion of employment in the Wellington district and the high diffusion in the Napier district are, along with some of the other results, pointers to the direction in which further research seems desirable. It might be helpful also to calculate the indices for a number of years so that trends could be observed, and to recalculate the indices with some groups of complementary districts such as Lower Hutt and Wellington and Napier and Hastings treated as units.

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[10] W. B. Sutch: 'Some Aspects of Regional and Urban Growth in New Zealand', *Industrial Bulletin*, Vol. 14, Nos. 3 & 4, 1958, pp. 3-13.

Conclusion

The three measurements described and illustrated with reference to New Zealand factory employment in this paper are useful devices which can be used to point up various aspects of distributions. Care must be taken in interpreting the results obtained in these ways because some of the statistical groupings used by government agencies tend to be heterogeneous. Furthermore, during the economic survey of an area or areas other considerations would have to be taken into account, such as the association between the various industry groups, the relationship between the cyclical and seasonal movements of the industries, and the allocation of productive resources between the provision of goods and services for sale locally and for sale outside the area. All these would be important influences on the viability and vitality of a local economy.

The indices themselves are easy to calculate and can be readily applied to a wide range of employment categories, and to areas ranging in size from functional districts within urban areas to larger divisions of a nation as a whole. With modifications they could also be applied to other criteria. Clearly the choice of the criteria and areas to be used will depend on the statistical information available and the purpose of the investigation, but in each case the results are most valuable if they are interpreted as ordinal rather than cardinal measures.

GEOGRAPHY IN SCHOOLS . . . .

7. *A Test of Basic Knowledge*

E. E. Owen[*]

DURING the last fifteen years profound changes have occurred in all aspects of the teaching of geography in schools in New Zealand. A *Social Studies Syllabus in History and Geography* has been operative in classes from standard two to form four during this period, and high hopes have been expressed for a greater measure of pupil interest and, by implication, of achievement, as a result of applying this self-styled 'new' approach to the previous separately-taught disciplines of history and geography. In this period too, a considerable number of university-trained geographers, increasing year by year with the establishment of departments of geography in the universities, has entered the teaching service. Perhaps the most notable change in this period has been the distinct improvement in the paraphernalia of teaching—better equipped classrooms, the use of filmstrips and films, the availability of large-scale maps, opportunities for field studies, and an ever-increasing volume and variety of pupil and teacher reference material incomparably better in quality of production and content than in prewar years. Add to this a growing volume of literature on methods of teaching the subject published in a variety of journals, and one should expect a definite improvement in pupil interest and achievement commensurate with these developments.

Assessment of Progress

To assess such changes measurement would have to be broadly based with a battery of devices to test comprehension, attitudes, factual knowledge and descriptive ability if comprehensive conclusions are to be made. Much the simplest form of assessment is the factual test which can be marked objectively and which, by adopting a short answer technique, can facilitate the coverage of several topics in a relatively short time. Conclusions drawn from such tests have unfortunately been criticised by some educationists who maintain that facts once used are easily forgotten but may be relearned in later teaching situations, whereas concepts may be retained for longer periods and interpretations from tests of these have more validity. Whilst this viewpoint cannot be ignored, facts nevertheless are important and cannot be disregarded.[1] If it is 'old-fashioned' to state this it is also to state a truth. Furthermore, some facts are more important than others because of their usage or usefulness and they are worth the effort of memorising. Such facts do not become 'geographic facts' but rather basic subject-facts or stock-in-trade facts vital to the understanding of techniques and concepts inherent and traditional in the discipline.

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[*] The writer wishes to thank the heads of the two high schools, the training college and university Department of Geography for the permission to administer the test to pupils and students, and the teachers who kindly cooperated in the task of supervision.

[1] The syllabus is very definite on this point: '. . . it is very necessary that every teacher should decide what he considers to be the most important facts connected with each topic that he proposes to cover. He should then see that the children understand these facts, and relate them to one another' ('Understanding the World', in *Social Studies in History and Geography, Primary School Syllabuses,* Wellington, 1954, p. 4).

In 1944 Garnier conducted an investigation into this matter of fundamental knowledge among senior and junior pupils at Wellington Technical College and students at Wellington Teachers' Training College.[2] In his concluding remarks he mentioned the desirability of conducting further inquiries along lines similar to his investigation. This suggestion has prompted the present inquiry, and the results offer the possibility of making a comparative analysis and of drawing tentative conclusions concerning any improvements or otherwise in standards of appreciation in the subject.

Any factual test which attempts to cover a wide range of subject matter must bear the imprint of the author's concept of what he considers to be fundamentally important. The intention to test classes in junior secondary schools and groups in institutions of higher learning meant that the test must not be too difficult for the lower age group nor absurdly simple for the higher groups. Sufficient questions must be included in the various sections of the test to allow valid average percentages to be calculated, yet the whole test should not be too long. These considerations should be taken into account when considering the value of the test. (A summary of the test is appended.)

The test was devised with average to good pupils in mind who had completed the primary-school course and had been taught by teachers with a lively interest in geography. The geography content in the *Social Studies Syllabus* was carefully examined and questions were framed around the work which should have been covered in the upper classes of the primary school. Unfortunately for the compiler of such a test, the syllabus is not very specific and one's interpretation of what factual content should emerge from the teaching of it would not necessarily be the same as another person's. In a trial form the test was administered to a small group of children and students, discussed with a number of interested teachers, and recast before it was administered in its final form.

There were thirteen sections in the test. Short answers, mainly one word, were required, and true-false or yes-no questions were not used, whilst only a limited number of the multiple choice type were included. There was no attempt to assess reasoning ability, comprehension or attitudes. The questions, in all, 130 in number, were straightforward and unambiguous, and a time of one hour was allowed. All the scripts marked and analysed were completed within this time. A liberal policy of marking was consistently applied; some questions demanded precise answers, in others a generous margin of error was allowed. Spelling errors were disregarded.

RANGE OF PUPILS TESTED

Four different groups completed the test and a total of 350 scripts were marked. Pupils and students, with the exception of the university students, were tested in February before the year's geography courses had commenced, and therefore the third-form pupils had completed the primary school course only, the fifth-form pupils had completed the core social studies course, and the training college students, with various qualifications in geography, were all new entrants. The one hundred third-form pupils were drawn from twenty-four primary schools which vary in size from large suburban schools to sole-charge country schools. These pupils were a selected group, above average in ability and in the upper classes of their form. This selection was made to reduce to a minimum the risk of difficulty being experienced in reading and interpreting the questions. The one hundred fifth-form pupils were all from one suburban high school and they were selected to obtain a fair cross-section of ability for their form. The training college students, also numbering a hundred, were drawn from forty-four secondary schools scattered throughout the areas administered by the Auckland and South Auckland Education Boards, with the exception that no students came from city schools.

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[2] B. J. Garnier: 'The Basic Geographic Knowledge of Young New Zealanders', *N.Z. Geographer*, Vol. 1, No. 1, April 1945, pp. 83-88.

The question as to what standard of performance could be expected from the varied groups taking the test is difficult to answer. Any figure must perforce be an arbitrary one. The performances in Garnier's test—very similar in pattern and approach to this present one—show that the third formers scored well above fifty percent in six of the ten sections, but Garnier does not comment on the ability of the pupils.[3] Bearing in mind the nature of the test and its close relationship to the syllabus content, and considering the ability of the third-form group, a score of fifty percent as a satisfactory performance for these pupils may not be unreasonable. Tables I and II show the average percentage marks, distribution of results, and an analysis of the test by sections for the four groups.

Clearly the group averages are disappointing, to a varying degree, for all groups, but particularly the averages of third-form pupils and training college entrants. The averages of the fifth-form pupils and university students bear the closest resemblance to expectations, but in both instances there is little cause for satisfaction. There is a very marked difference between boys and girls in the third and fifth forms but this difference is small at training college and university, although the men still record higher averages. A wide range of marks in the third and fifth forms and among training college students is apparent. The smallest range—among university students—is where one would expect it, but the lowest scores in this group seem much too low for students who have successfully completed a first-year university course. There are serious deficiencies shown in some sections of the results, most notably in mathematical geography in every group, and in map knowledge for third and fifth formers and training college students. Taking account of age and training the most creditable result was that of the fifth-form boys who scored as well on average as the training college women students and in one section, 'Identification—New Zealand', were the equal of the university students.

POST-PRIMARY SCHOOL ENTRANTS

Inferior teaching in the primary school can adversely affect children's attitudes towards a subject and these attitudes may persist through secondary education. The poor results of the above-average third-form pupils indicate a lack of awareness on the part of primary-school teachers of the essential importance of building up a fund of background knowledge. Without this factual information, or with an indifferent accumulation of it, ideas cannot be developed on the sound principles of discussion and the formulation of ideas based on ascertainable, obtainable and *remembered* detail.

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[3] See Garnier, *op. cit.*, Table I, p. 85.

A fund of information consistently and methodically added to as part of a defined and balanced course is an essential element in the successful progress of a pupil through his school years, for he derives from it the important constituent of success—confidence. This is particularly important in a broadly-based subject like geography which embraces a wide field of factual content, and to which are constantly added new-found facts, ideas and concepts which modify, cancel or add to previous accumulations of knowledge. This vitality in the subject is the essence of scholarship and learning in a broad sense, but a pupil's awareness of it cannot be gained unless there is a healthy respect for and an assimilation of facts, the proving-base of all ideas.

Whatever the aims of a primary-school course, a secondary-school teacher has the right to expect that entrants to his class have some common core of knowledge in subjects taught in the primary school as well as interest and an impulse to learn. The primary-school social studies syllabus could serve as a satisfactory core in geography, with reservations, *if it is used as intended and the content taught to children.*[4] It is suspected, however, that too many teachers either ignore the syllabus and teach what they like, hence the devastating repetition of topics like Maoris and Eskimos, or, worst sin of all, do nothing until prompted by external pressures.

Children in upper primary-school classes are at an age of transfer from imaginative to realistic thinking, they are avid for detail, and learning and remembering can be enjoyable pursuits. Teachers of these classes should appreciate their unique role in this respect. If indifference to or neglect of syllabus content is symptomatic of teaching at this age level, serious consequences may result in post-primary schools, for teachers faced with inadequately prepared entrants tend to resort to 'cramming', which leads to boredom instead of creating teaching situations in which rationalistic thought may develop.

Weaknesses of Social Studies

The social studies syllabus itself, however, has inherent weaknesses. It has yet to be proved that the 'social studies' approach could do more than a separate treatment of history and geography. The early spirit of the syllabus seems to have foundered in a sea of vague conceptions about 'citizenship', 'democracy' and 'social situations', and little that is constructive has been produced to develop its content into a more detailed, progressive and balanced programme suitable for class by class implementation. Certainly the essence of geography as a study of the earth's surface has been lost, and with it some of its essential features. A reflection of this is the poor score of the third-form pupils in map knowledge. An analysis of four of the questions in this section shows that sixty-eight percent could not use a simple scale to calculate a distance; only fourteen percent could draw a contoured hill with any degree of accuracy; eighty-five percent were unable to identify the symbol for a level crossing, and only *one* pupil in one hundred could give an accurate grid reference. By adopting in the lower standards of the primary school a simple approach to the study of maps based on the children's local knowledge and experiences, and by careful progressive teaching with an emphasis on activity in later classes, children can by the age of eleven or twelve read and understand large-scale maps. Skill in the use of such maps is a valuable asset, for on a map information can be recorded simply and accurately, and most important, it is a unique source of information. Yet the stronger advocates of the 'social studies' approach have tended to disparage instruction in mapwork *per se*. Such attitudes have led teachers astray to an extent that it is suspected, judging from the scores in the test, that even reference to atlases for the location of places is a disappearing practice in classrooms. Of these bright third-form pupils, eighty-four percent could not identify on a world outline map the River Ganges, and fifty-eight percent the Congo, whilst sixty-six percent failed to locate Palmerston North, and seventy-nine percent East Cape. Of these one in seven named it the Cape of Good Hope!

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[4] The 'intention' in this context can be gathered from reading the suggestions for treatment following the content for each class, and the section, 'Some Suggested Methods', in the syllabus.

TABLE I

DISTRIBUTION OF RESULTS AND PERCENTAGES

Percent Marks	*University Second Year*			*Training College*			*Fifth Form*			*Third Form*		
	Men	*Women*	*All*	*Men*	*Women*	*All*	*Boys*	*Girls*	*All*	*Boys*	*Girls*	*All*
81+	5	7	12	2	1	3	–	–	–	–	–	–
66–80	16	19	35	7	12	19	13	3	16	1	–	1
51–65	1	2	3	11	35	46	22	12	34	13	3	16
36–50	–	–	–	9	17	26	14	20	34	19	11	30
21–35	–	–	–	1	4	5	1	14	15	20	14	34
0–20	–	–	–	–	1	1	–	1	1	7	12	19
Total	22	28	50	30	70	100	50	50	100	60	40	100
Average Percentage	77.1	75.2	76.0	58.0	55.3	56.1	57.4	44.4	50.9	36.9	29.8	34.1

TABLE II

PERCENTAGE MARKS OBTAINED BY VARIOUS GROUPS

Section	*No. of Questions*	*University Second Year*		*Training College*		*Fifth Form*		*Third Form*	
		Men	*Women*	*Men*	*Women*	*Boys*	*Girls*	*Boys*	*Girls*
Directions	8	82	86	72	73	75	56	64	53
Terms	8	82	87	61	66	69	51	47	36
Map Knowledge	8	68	74	47	42	42	29	19	10
Mathematical Geography	8	47	42	39	28	28	16	29	16
Climate	8	68	64	54	47	34	28	32	22
Vegetation	5	85	85	63	69	57	51	37	30
Agricultural Geography	15	83	82	54	55	55	50	43	34
Towns	10	80	75	57	50	44	30	30	20
Population	5	77	65	76	52	56	42	42	33
New Zealand—General	15	80	70	58	55	68	53	38	27
Identification—World	20	80	83	65	64	61	49	41	30
Identification—New Zealand	10	81	79	75	77	80	67	45	40
Values	10	73	75	51	45	57	41	36	33

A random analysis of other answers further emphasises the lack of knowledge of these post-primary school entrants. Fifty-eight percent could not identify a river estuary on a simply-drawn sketch map; only five percent knew the latitude of the Tropic of Capricorn, and one percent that of the Arctic Circle; forty-eight percent could not name the capital of Australia; sixty-three percent did not know the approximate population of their home town; eighty-one percent could not name a citrus-growing area in New Zealand; sixty-two percent were unaware that wool is one of New Zealand's chief exports; and fifty-two percent could not name a railway junction in the North Island. Furthermore, in many instances, a poor grasp of vocabulary was shown—even the meaning of words such as 'junction' and 'export' was either misunderstood or not known.

It is obvious that this situation is most unsatisfactory and is a cause for serious concern. The social studies syllabus should be re-examined critically and a more detailed outline of content prepared for teachers, it then being the responsibility of headteachers to see that the content is taught and not neglected. Greater emphasis must be placed on learning and remembering in the upper classes of the primary school, and teaching methods which do not develop these essential processes should be either modified or discarded.

Training College Entrants

In spite of the differences in average scores the overlap between training college students and the third-form and fifth-form pupils is too great to give satisfaction. Seventeen percent of the third-form pupils gained better scores than thirty-seven percent of the training college students, a disturbing feature when it is realised that some of these students may be called upon to teach the subject to senior primary-school classes during and immediately following their training course. It is more disturbing, however, when it is realised that the larger percentage of students do not advance their study of geography beyond their post-primary school level during their training course. In a widely recognised system of credit courses in training colleges, students select subjects for advanced study, and unselected subjects, compulsory for all, are of necessity short, are mainly concerned with professional skills, and do not extend generally beyond levels compatible with content in the primary-school syllabus. Table III sets out the range of scores and average percentage scores for students with different qualifications in geography.

The students with qualifications at the level of University Entrance were distinctly superior in the test to the other students, yet even at this level the average score is very little better than that of the fifth-form boys (Table I), and on this count is hardly satisfactory. Allowance must be made, however, for the fact that these students were drawn from non-urban secondary schools where staffing difficulties are more pressing than in urban schools, and where the quality of teaching may vary more widely. More serious to contemplate are the students with School Certificate qualifications and less in geography. Of these students, sixty percent gained fewer marks than seventeen percent of the third-form pupils, and their average scores were well below the averages for those in the fifth form.

It is apparent from this evidence that factual details are quickly forgotten. That

TABLE III

Training College Students:
Distribution of Results Based on Qualifications in Geography

Percentage	*University Entrance*	*School Certificate*	*Fourth Form*
81+	2	1	–
66—80	16	2	1
51—65	31	8	4
36—50	10	13	6
21—35	1	2	2
0—20	–	–	1
Total Number	60	26	14
Average Percentage	60.6	51.3	44.3

many students during training will enrich their academic knowledge is certain, but it is also very obvious that a higher entrance qualification than School Certificate would provide a sounder beginning. If the present low qualification of entry into the teaching profession is to remain, students with meagre qualifications ought to be encouraged to improve their academic status, or opportunity and incentives should be created for attendance at in-service training courses during the early years of their teaching career. Teachers of the young must be well informed, among other qualities, and without a solid accumulation of factual knowledge it is difficult to imagine how the ability to make mature judgments and weigh evidence carefully can develop in their teaching of geography.

An analysis of selected questions illustrates the generally unsatisfactory scores of training college entrants compared with fifth-form pupils, and points to serious gaps in the factual knowledge of both (Table IV).

TABLE IV

Analysis of Selected Questions

Detail of Question	*Percentage Correct*	
	Fifth Form	*Training College*
Compass directions (five questions correct)	68	72
Distance calculation from map scale	45	44
Grid reference	6	8
Latitude of Tropic of Capricorn	2	16
Latitude of Arctic Circle	0	5
Instrument to measure air pressure	34	65
do. wind speed	0	4
do. temperature	77	80
British trading port in China	53	53
Total Maori population (very approximate)	5	19
Named wool in three chief exports	49	75
Height of One Tree Hill, Auckland (very approx.)	51	26
do. Mount Cook do.	53	52
Identified East Cape on outline map	37	55
do. New Guinea do.	73	72
do. Congo do.	72	58

Whilst it would unduly prolong this statement to consider each section of the test in detail, there are two matters worthy of comment. It is readily admitted that factual material may be quickly forgotten and that facts may be relearned with little effort. If, however, a topic is included in a syllabus at a particular level it is assumed that such content is not only suitable for that age level but is a part of a broader developmental course, and that subsequent teaching will reuse the knowledge in different teaching situations. This recall and reuse should result ultimately in remembered detail. A comparison of the average scores for the four groups in mathematical geography (Table II) indicates that little is remembered in this work after initial teaching in the primary school (assuming that the topic is taught as suggested in the syllabus) and that little or no reference to it occurs until at least the fifth form. Such a situation poses the questions whether the topic should be taught at all or whether it should be taught later when more purposeful teaching situations may develop. That aspects of mathematical geography should be taught is beyond question to a geographer, and that an intelligent teacher would use and reuse the knowledge is certain. Again, the syllabus may be at fault in not giving more explicit instructions to teachers, or, post-primary schoolteachers of junior forms may not be sufficiently cognisant of the work done, or which should be done, in primary schools.[5]

The other consideration is the disparity in performance between boys and girls revealed in the average total scores (Table I) and the averages by sections (Table II). The results of two other tests show the same tendencies.[6] The differences are consistent enough in this evidence to be a matter for attention by all teachers, but particularly by post-primary school teachers where the differences between boys and girls are pronounced. The reasons for this are obscure, and in the absence of objective evidence one may only speculate. As all post-primary school pupils take the core social studies course, and all pupils after the fourth form select their subjects in preparation for public examinations, personal interest may be a strong factor when it is seen that the differences between men and women students in training college and university are much less than at junior levels. If interest is a factor the situation presents a challenge to teachers to create greater interest in the subject among girls who obviously should perform as well as boys.

A Comparison of Standards

It would be misleading to draw too many detailed comparisons with the results of Garnier's test in 1944. Although both tests had the same purpose, were similarly devised and tested comparable groups, the tests differed in detail. Nevertheless some comments have validity in general terms. In considering comparative scores between sections of factual knowledge, Garnier stated that '. . . with the exception of those [questions] on climate, regions, and vegetation, the more technical questions were not so correctly answered as those of a more general nature'.[7] The same statement can be repeated today. By grouping together the sections dealing with aspects of physical geography (terms, mathematical geography, climate and vegetation) and those dealing with aspects of cultural geography (towns, population, agricultural geography and New Zealand—general) evidence is revealed as set out in Table V.

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[5] The need for cooperation between primary and secondary schoolteachers in this respect is referred to in the syllabus (*op. cit.*, p. 4).

[6] Garnier: *loc. cit.* and John E. Watson: 'The Attainment of Teachers' College Students in Primary School Subjects', *Entrants to the Teaching Profession*, Interim Report No. 3, N.Z. Counc. Educ. Res., Wellington, 1958, p. 24.

[7] Garnier: *op. cit.*, p. 84.

With one exception, and not a notable one, the scores in every group are poorest in physical geography. The differences between the two sections are greatest from the fifth form onwards and the scores for both are almost the same at the third-form level, yet this appears paradoxical when the various syllabuses are examined. Whereas in primary schools and the lower forms of secondary schools a definite emphasis is placed on people in geographical aspects of the syllabuses, in advanced forms at secondary schools greater emphasis than previously is placed on the teaching of physical geography, and at university level there is a rough balance between the two.

TABLE V

AVERAGE PERCENTAGE RESULTS BY MAJOR CATEGORIES

Category	*Number of Questions*	*University Second Year*		*Training College*		*Fifth Form*		*Third Form*	
		Men	*Women*	*Men*	*Women*	*Boys*	*Girls*	*Boys*	*Girls*
Physical	29	70	69	54	52	47	36	36	26
Cultural	45	80	73	61	54	56	44	38	25

One would expect therefore, that differences in performance should occur at lower levels of teaching but should be less evident at higher levels, the opposite of the evidence. The scores of the fifth-form pupils bear the closest resemblance to expectations in this context.

The reasons for this paradox are obscure. Whether junior pupils can remember more easily the taught facts of physical geography; whether they show more interest in this section of geographical knowledge; whether the teaching of cultural geography at this level is generally poor (a point which has been alluded to); or whether cultural geography with its complexity and profusion of detail is not sufficiently delimited and defined for teachers at this level, are some points which have relevance to the issue. In the absence of objective evidence no definitive statement can be made. It would be pertinent to question, however, why there is so *much* emphasis on people in junior geography teaching, for the results of the test suggest that pupils perform as well in physical geography as in cultural geography, and interest is a dominant element in response and achievement.

Of the sections devoted to general questions, the section of Garnier's test which produced the poorest answers was the knowledge of towns, their location and importance.[8] The results of the present test illustrate the same deficiency, particularly up to training college level (Table II). When asked to identify on a map Moscow, Delhi, Peking, Tokyo and New York, only twenty-nine percent of the third-form pupils gave correct answers, and only thirty-five percent could name an important shipbuilding centre in the British Isles. The capital of Canada was known to only forty-nine percent of the fifth-form pupils, and only forty-eight percent of training college students. (In Garnier's test accurate answers in these questions were forty-six percent and sixty-two percent respectively.) That pupils in each class should learn the location and importance of towns when studying topics is undeniable. Teachers must devise methods to bring about the necessary learning processes. This is not to imply that rote methods of learning should be adopted but that a greater emphasis should be placed on memorisation. Perhaps the most solid improvement could be achieved in forms one and two where early habits of learning and reference should be developed.

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[8] *ibid.*, p. 87.

In the section of the test defined as 'values' the scores of the training college students and third-form pupils were the least satisfactory when compared with the scores in Garnier's test. The same or similar questions were asked in both tests. As in Garnier's test better estimates were made of weather conditions than of heights and distances, but many third-form pupils had difficulty in understanding the phrase 'average annual'.

CONCLUSION

In conclusion, making allowance for possible variations, this present survey demonstrates that the performance of third-form pupils and training college students is below the standard achieved by these levels in 1944. On the other hand the fifth-form pupils appear to have achieved a roughly comparable standard. Taking account, however, of the definite improvements in teaching aids and facilities in the interim, and of presumably more liberal teaching methods today, these performances do not demonstrate that any advances have been made commensurate with these changes. It is conceded that this judgment is not comprehensive, but in the absence of dispassionate evidence concerning the development of those qualities of purpose and attitude aimed at in the social studies syllabus—in both primary and secondary schools—the performances in the test must give cause for concern.

One further comment is necessary to dispel possible misinterpretations of the test. The nature of the test and the tone of the comments may give rise to a belief that what is advocated in the teaching of geography is a return to the old methods of forcing pupils to memorise confusing and unrelated lists of places and products, locations and landform features, routeways and rainfall figures, and so on. Such an interpretation would be very far from the author's beliefs. Teachers who employ such outmoded methods and use such an obsolete approach to the teaching of geography do a dis-service to an exciting subject and to the enquiring minds of pupils. The attitude and approach of the teacher to subject matter is of paramount importance, for pupils must above all develop critical minds. This may be achieved by examining a variety of source material in different forms, by demonstrating to them the relationships between otherwise isolated facts, and by applying the knowledge gained in purposeful and concrete situations. Pupils must be brought to a point of *understanding*. In this context, remembering—or memorisation—is an integral part of learning in a broad sense. In this context too, the test and comments should be evaluated.

A BRIEF SUMMARY OF THE TEST

Direction. Five compass points to be identified on a compass diagram with north pointing to the top right hand corner of the page. Directions of Wellington, Gisborne and Sydney, Australia, from Auckland.

Terms. Sketch map of a land and sea area; the words, estuary, bay, cape, peninsula, isthmus and strait to be written in. Simple definitions of a 'pass' and 'erosion'; terms to be stated.

Map Knowledge. Draw contoured hill; calculation of distance from a scale; give a grid reference; identify symbols (illustrated) of a trigonometrical station, shelterbelt, post and telegraph office, and level crossing.

Mathematical Geography. Questions relating to earth rotation, prime meridian, international date line, March equinox; differences in time and hours of daylight at stated places; latitudes of Capricorn and Arctic Circle.

Climate. Names of weather recording instruments, tropical cyclone and the edge of an advancing air mass; direction of a land breeze and winds in a high pressure system; definition of 'isobar'.

Vegetation. Types found in tundra regions, coniferous forests and prairies; descriptions of 'scrub' and desert.

Towns. To name capital cities of Canada, Australia, South Africa and Eire; a shipbuilding centre, textile town and fishing port in British Isles; a wheatlands town in Canada, coalmining town in Australia, and British trading port in China.

Population. Approximate totals of New Zealand population, Maori population and home town. Order of size of New Zealand's four largest cities and four named countries.

Agricultural Geography. World agriculture—crop areas and practices; New Zealand—areas for well known products, cattle breeds, lambing season months, and chief export commodities.

New Zealand—General. Location of towns and activities, e.g., name timber town, holiday resorts, goldmining towns, exotic forests. Communications, e.g., name railway junction, Cook Strait ferry terminals, and airports.

Identification—World. Outline map of world with following marked for identification: Moscow, Delhi, Peking, Tokyo and New York; Rivers Nile, Volga, Ganges, Murray-Darling and Mississippi; Rockies, Andes and Himalayas, and the Mediterranean and Caribbean Seas.

Identification—New Zealand. Outline map of New Zealand with following arrowed for identification: Great Barrier Island, East Cape, Hawke Bay, Banks Peninsula, Foveaux Strait, Westport, Palmerston North, Mount Egmont, Waikato River and Manukau Harbour.

Values. Heights of One Tree Hill and Mount Cook; speed of a gale force wind; noon temperatures of a very hot day, very cold day; rainfall of a really wet day, and average annual rainfall of a known place; distances from Auckland to Christchurch, and Rangitoto Island from mainland.

GEOGRAPHIC NOTEBOOK

IN THIS ISSUE. During August of this year the New Zealand Geographical Society held its triennial conference at Massey Agricultural College, Palmerston North. A full report of this conference will be given in the next number of the *New Zealand Geographer*, but it is not inappropriate that the presidential address should be published now, for Keith Buchanan, Professor of Geography in the Victoria University of Wellington, made most significant and timely references to the dynamic aspects of geography in planned societies. There may be some who will not agree with Professor Buchanan's interpretations, but here is a reasoned plea for at least the greater and wider appreciation of political geography and all that it implies.

The role of man in nature is a geographical theme that extends particularly from George Perkins Marsh to William L. Thomas Jnr, with Carl O. Sauer as a great exponent in America. In New Zealand no one has been more appreciative of this problem than Kenneth B. Cumberland, Professor of Geography in the University of Auckland. His present article is adapted from a paper delivered to the Tenth Pacific Science Congress held at Honolulu in August 1961 as the New Zealand contribution to a congress symposium, 'Man's Place in the Island Ecosystem'.

Professor Peter Scott of the University of Tasmania is no newcomer to the pages of the *New Zealand Geographer*, and it is again as an expert on the agricultural geography of Tasmania that he makes his contribution. To New Zealanders the agricultural problems of this southernmost state of Australia are of particular interest since they exhibit many features that characterise those of the dominion, even though their Australian nature cannot be denied.

Both Mr T. F. Kennedy and Dr G. J. R. Linge have also contributed to this journal previously, but on the present occasion Mr Kennedy is concerned with rural settlement forms in the county of Franklin, not in the Pacific Islands, whilst Dr Linge confines himself to a methodological statement that will help in the interpretation of the distribution of industry in New Zealand. Mr Kennedy is Lecturer in Geography at Ardmore Teachers' College, and Dr Linge is now a Fellow in the Research School of Pacific Studies at Canberra.

It is seven years since the last contribution to 'Geography in Schools' appeared, and although many advances have been made since 1954 in the pedagogic sphere, a chronic problem remains—the lack of specific knowledge among those taught geography. Mr E. E. Owen, Lecturer in Geography at Ardmore Teachers' College, again highlights this failing, and makes pertinent suggestions, for more than ever in this day and age does it behove the New Zealander to be aware of what occurs elsewhere in the world, and to understand contemporary problems—the agrarian and industrial revolutions in Asia and Eastern Europe, the implications of a changed economy in the dominion consequent upon restricted markets in Western Europe, the role of industry in that economy, and the effect of agricultural practices on the physical environment, to mention but a few which are elaborated further in this number of the *New Zealand Geographer*.

Notes, commentaries and reviews have been written by Miss Rilda Gorrie and Mr R. D. Hill of the University of Auckland; Mr S. H. Franklin of the Victoria University of Wellington; Dr Jane M. Soons and Mr W. B. Johnston of the University of Canterbury; Dr G. M. Neutze of the School of General Studies, Australian National University; Mr M. G. A. Wilson of the University of Melbourne; Dr G. R. Lewthwaite of San Fernando State College, California; Professor Cumberland, Dr Linge and the editor.

THE 1961 CENSUS. A census of population and dwellings in New Zealand, excluding Pacific territories, was taken at midnight 18 April 1961. In the classification of census results several innovations have been made. A new category of urban centre, the county town, will give data for small unincorporated settlements that were previously lacking. Statistical areas now replace provincial districts, and these latter will eventually be abandoned. Auckland provincial district, for example, is now split into four areas: Northland, comprising the northern counties from Mangonui to Otamatea; Central Auckland, the counties from Rodney to Franklin; East Coast, the area north of Wairoa; while South Auckland–Bay of Plenty comprises the remainder of the provincial district. Three new urban areas have been defined: Rotorua (1961 population 25,074), Tauranga (24,759), and Whangarei (21,773).

On census night the total population figures were as set out in the table.

	1956	*1961*	*Increase*	*Percentage Increase*
North Island ..	1,497,364	1,684,139	186,775	12.5
South Island ..	676,698	729,925	53,227	7.9
New Zealand ..	2,174,062	2,414,064	240,002	11.0

Thus the total increase represents sufficient numbers to people a city about the size of metropolitan Christchurch. Of this total about 200,000 (83 percent) came by natural increase and 40,000 (17 percent) by net migration, giving New Zealand a natural increase of nine percent for the quinquennium. The intercensal increase for the dominion as a whole represents a fall of 1.1 percent when compared with the 12.1 percent for 1951-1956.

In the last five years the proportion of the population living in the North Island has increased by one percent from 69 percent in 1956, thus continuing a trend evident since 1901 when the proportion in each island was approximately the same. Although northward migration is one factor in this trend, it is likely that natural increase in the North Island is faster than in the South Island because of the much higher proportion of Maoris in the North Island. The Maori increase between 1956 and 1961 was 20.3 percent. The pattern of increase is also uneven in other respects. The cities and towns are growing much faster than the rural areas, but towns are increasing at a faster rate than cities, while most rural areas are experiencing loss of population, if not absolutely, then relative to the growth of the population as a whole.

Grouped data for all settlements having urban function show that towns of between 5,000 and 20,000 people, especially towns in the upper half of this range, have fastest rates of growth. Nevertheless, the numbers involved are very much smaller than in the four main centres and in other cities. It is in the four metropolitan regions, Auckland (1961 population 448,218), Wellington–Hutt (249,528), Christchurch (220,322) and Dunedin (105,053), and particularly in Auckland, that large numerical increases have taken place. The total increase in these regions from 1956 to 1961 was 124,971—enough people to fill Wellington City. Of this number, about 53 percent reside in Auckland which now emerges as New Zealand's primate city, having an intercensal increase rate of 17.6 percent, the highest rate in this category. Within the next eight to ten years, at present rates of increase, Auckland faces the prospect of adding a 'city' the size of present Dunedin, and Christchurch a 'city' the size of present Hamilton, with Wellington lagging a little behind Christchurch, and Dunedin a long way behind the others.

To a lesser extent, the urban areas with populations of between 20,000 and 50.000 will share the urban growth, and at an increasing rate, although the recent numerical increase is less than half that of the four main centres. Most other towns and villages with populations greater than a thousand will also share in this general urban growth, with the share of the total urban population tending to rise because the increase rates of these towns are generally greater than those of the metropolitan regions.

Although unreliable because they include unincorporated townships in their totals, county statistics give some indication of what is happening to the rural population. Disregarding the urban fringe counties of Waitemata and Manukau, adjacent to Auckland, of Hutt and Makara, adjacent to Wellington–Hutt, and of Waimairi, Halswell, Heathcote and Paparua, adjacent to Christchurch, the total county population has increased by only 3.3 percent in the last five years. This overall increase, in itself a decline relative to the increase of the whole population, masks an absolute fall in many areas. Only the counties of Waikato, Waipa and Matamata in the Waikato, of Tauranga, Rotorua and Taupo in the Bay of Plenty-Volcanic Plateau, of Hawkes Bay and of Eyre in North Canterbury show increases above the national average of eleven percent. Even in these counties it is probable that a portion of the increase represents urban growth rather than such rural development as subdivision of holdings and the bringing of waste land into production.

Elsewhere, in both dairying and sheep-farming areas, the pattern is one of slowly increasing or declining population. In a number of areas a recently-initiated decline follows postwar increases. This is true for Northland, the Coromandel Peninsula, East Cape, Hawkes Bay (except Hawkes Bay County), Taranaki, the King Country, Wanganui, Rangitikei, and the hillier portions of the Manawatu and the Wairarapa. South Island areas which share this pattern are South Canterbury, and coastal and Central Otago. Elsewhere in the South Island the postwar rise has slowed, but Westland and Banks Peninsula show a continuation of the downward trend revealed in the 1951-1956 period.

Some reasons for the decline in the majority of county populations may be suggested. Rural areas shared the general rise in population during the immediate postwar decade, but children born in this period and now beginning to enter the workforce have limited employment opportunities in rural areas. They are therefore moving into the towns. Furthermore, rises in rural production have not been accompanied by significant rises in the rural workforce; indeed the reverse may be true.

When considering areas of almost stable or falling population in counties and included towns it is noteworthy that, except for villages and on the West Coast, there has been a rise in town population and a fall in county population. For example, the county population of the Wairarapa shows a decrease of some 200, although the town population has risen by 3,200, of which perhaps half represents rural–urban migration.

As for the future it may be suggested that a growing proportion of New Zealand people will live in cities and towns of all sizes above 1,000, but the greatest numbers will continue to be added in the largest cities, especially Auckland and Christchurch. Within the four main centres the pattern of decay at the centre and new growth at the periphery will probably continue, although it may be questioned if the dis-economies inherent in such a pattern should continue to be tolerated. However, a slowly rising proportion of the urban population will come to be located, not in the four main centres, but in other towns which show faster growth rates. A number of smaller towns within easy reach of larger urban concentrations will probably grow as dormitory areas for their larger neighbours. Centres such as Pukekohe, Ngaruawahia, Cambridge, Inglewood, Feilding and Carterton already show this trend. Most villages, except those situated to cater for passing motor traffic, will probably continue to decline because they tend to be bypassed in favour of large centres which offer greater variety and specialisation of services.

A major concern will be to provide capital at a rate sufficient to meet population growth. Based on an average cost of £4,000 per dwelling unit, including cost of land and servicing, and allowing three persons per unit, some £400,000,000 will need to be invested in housing alone in the next five years. The major task of the next quinquennium will be to ensure an economic growth sufficiently rapid to meet the needs of a rapidly growing population.—R. D. HILL

PROVINCIAL INCOME ESTIMATES. The main purpose of this note is to present the results of an attempt to estimate New Zealand's national income by provincial districts for the calendar year 1955, and to give some indication of the sources used. The attempt was made as part of a much larger study of location of industry in New Zealand (see G. M. Neutze: *A Theoretical and Empirical Evaluation of the Economics of Location with Special Reference to New Zealand*, thesis for D.Phil., Oxford, 1960), and the basic source of data was the *National Income Sector Accounts* for 1952-1953. For each sector the gross value of output was projected forward to 1955 and allocated between provincial districts at the latter date. In order to estimate the net national income accruing in each the value of gross output was multiplied by the ratio between gross and net value of output for each section as shown in the 1952-1953 accounts.

Projection forward of the gross value of output was carried out by breaking down the gross value of output for 1952-1953 into commodities or commodity groups for which statistics of output were available, if possible, both on an annual and a provincial basis. In sectors where this was possible a useful check of the completeness of cover, in the commodities comprising gross output in 1952-1953, was given by comparing the value of the commodities used with the gross value of output shown in the accounts. In many sectors projection forward and provincial distribution required the use of different, and often far from ideal statistical series. The actual sources used are outlined briefly below, and the results are summarised in Table I.

Farming. No suitable statistics are available of the total value of production by years or by provincial districts. Hence detailed estimates were made for each of nineteen commodities or commodity groups, and separately for investment in livestock, machinery and other capital goods. Much of the detailed information available is given for land districts in the annual *Farm Production Statistics*. The use of land district boundaries to approximate provincial boundaries caused serious error in only two places and these errors were corrected by transferring the output of the counties of Amuri and Cheviot from Canterbury to Nelson and by the less satisfactory expedient of transferring one fifth of the value of output of Westland Land District to the Nelson provincial district.

In estimating the value of output the attempt was made to value products at the price paid at the farm gate. Seven percent of the market value was deducted for transport and marketing, except for wool and dairy products. From wool a separate deduction of five percent only was made because of the lower marketing charges per unit of value which prevail for that product. Dairy products are always quoted at farm-gate prices.

The details of the method of estimating the value of output for each section of the farming industry will not be given but the following example of the method used for beef (excluding veal) is typical. The average value per ton was estimated from the value per ton of beef used as an input in the meat freezing and preserving industry. The *New Zealand Official Yearbook* records the total tonnage of production annually so that total value of production could be projected forward. Allocation of the total value of output between provincial districts was on the basis of total numbers of beef cattle carried in each land district. When the gross value of production for the whole farming industry was computed the net values could be estimated.

Forestry and Logging. Sales to sawmills and inputs to pulp and paper mills are the chief outputs. The value of output of pit props, fence posts and firewood was estimated from the 1952-1953 accounts as the value of sales to the mining, farming and household sectors. They were projected forward and were allocated between provincial districts on the basis of sales to sawmills, except that a deduction was made from the value for the Auckland provincial district because of the relatively high concentration of forestry in that district. Capital investment was estimated to have increased in the same proportion as output and was allocated between provincial districts as the value of output. The value of output was projected forward as a whole by the use of the index of forestry production shown in the yearbook.

Hunting and fishing. Values of output figures and data allowing calculation of provincial distribution are available in the annual reports of the Marine Department (fishing) and the Department of Internal Affairs (hunting), in the yearbook (fish oils) and the *Local Authorities Handbook* (rabbits).

Mining and Quarrying. The value and distribution of output can be estimated from the annual reports of the Mines Department, and the value of output was increased by the ratio shown in the yearbook.

TABLE I

INCOME BY PROVINCIAL DISTRICTS AND SECTORS IN 1955*

	Auckland	*Hawkes Bay*	*Taranaki*	*Wellington*	*Marl-borough*	*Nelson*	*Westland*	*Canterbury*	*Otago*	*Southland*	*New Zealand*
Farming	56.451	14.273	10.442	23.729	3.186	6.840	.806	22.087	13.622	13.883	165.319
Forestry	4.617	.266	.442	.646	.025	.483	.574	.378	.246	.253	7.929
Hunting and Fishing ..	.562	.142	.034	.266	.169	.179	.214	.393	.441	.601	3.001
Mining	3.639	.069	.220	.642	.048	.955	.197	.270	.479	.610	7.130
Manufacturing: Primary Products Processing ..	8.737	1.227	2.386	2.941	.132	.175	.053	2.128	.946	1.720	20.445
Other Manufacturing ..	62.253	4.573	3.364	38.107	.690	2.590	.953	22.860	11.340	3.442	150.172
Building and Construction	29.722	2.702	2.015	13.129	.918	2.048	.437	8.540	6.846	2.063	68.383
Public Utilities	7.291	.949	.536	3.651	.154	.799	.322	2.846	1.486	.751	18.785
Transport and Communication ..	24.841	2.615	2.360	17.311	.775	2.172	.830	9.090	5.873	2.556	68.423
Wholesale and Retail Trade	45.402	4.700	4.754	30.179	1.016	2.621	.946	17.936	8.512	5.084	121.150
Banking and Insurance ..	2.709	.337	.252	2.277	.065	.168	.051	.995	.609	.266	7.729
Defence	2.780	.215	.051	5.011	.017	.039	.006	1.136	.209	.034	9.498
Public Administration ..	5.782	.500	.683	5.905	.172	.452	.123	2.238	1.078	.390	17.323
Services	35.304	4.653	3.697	22.680	1.067	2.878	1.077	14.392	8.619	3.519	97.886
Households	15.474	1.840	1.730	7.912	.460	1.324	.350	5.520	3.110	1.509	39.229
TOTALS	305.564	39.061	32.966	174.386	8.894	23.723	6.939	110.809	63.416	36.681	802.439

*Figures represent thousands of pounds.

Manufacturing: Primary products processing. All the required statistics are available in the annual *Industrial Production Statistics.* This sector includes only the meat freezing and preserving, butter and cheese, and milk products other than butter and cheese industries.

Other Manufacturing. Again the relevant information is in the *Industrial Production Statistics,* though some adjustments had to be made to allow for the industries activities of which are not recorded in the report.

Building and Construction. The main statistics used for projection were of building permits, Ministry of Works construction, and construction activities of local authorities. The allocation between provincial districts was on the basis of employment in building and construction as shown in the census of population, 1951.

Public Utilities. The main outputs took the form of expenditure by the New Zealand Electricity Department, the electricity supply authorities, the value of gas supplied by local authorities, and the expenditure of land and urban drainage boards. Allocation between provincial districts was again on the basis of the 1951 census returns.

Transport and Communication. Projection forward was on the basis of information contained in the *Railways Statement,* the yearbook (road transport), the Local Authorities Handbook (harbour board activities), the annual report *Shipping and Other Transport Statistics* (shipping and air freight), and the annual report of the National Airways Corporation (passenger air transport). The annual reports of the Post and Telegraph Department and the New Zealand Broadcasting Service gave information of the services rendered in communication. Census figures were used for provincial allocation.

Wholesale and Retail Trade. The quarterly *Retail Trade Statistics* permit projection forward and the *Census of Distribution* for 1953 permitted allocation by provincial districts.

Banking and Insurance. Projection forward is on the basis of bank deposits, insurance premiums and advances of the State Advances Corporation. Provincial distribution was based on employment in 1951.

Defence. Projection forward was on the basis of information contained in the annual reports of the defence departments. Owing to wartime abnormalities in both 1945 and 1951, provincial allocation was on the basis of the 1936 census.

Public Administration. Projection is on the basis of total taxes raised and provincial allocation on the basis of employment in 1951.

Services. Projection was on the basis of the increase in national income and provincial allocation was on the basis of employment in 1951.

Household. The main source of income of this sector is from rents of dwellings, paid or imputed. The value of output was increased on the basis of building permits compared with the number of occupied dwellings at the earlier date and also increased by an index of building costs. Provincial allocation was on the basis of total population.

Although the main purpose of this note is to present results which may be of use to others, it appears worthwhile to comment briefly on the income figures per head of population as shown in Table II. However it must be remembered that the above calculations involve some very crude methods and the results should not be considered as more than a first approximation. In particular the method used estimates income *generated* in each provincial district and takes no account of income generated in one district which may accrue, through the ownership of assets, to residents in another district.

TABLE II

AVERAGE INCOME PER HEAD IN PROVINCIAL DISTRICTS IN 1955

Auckland	£363.2	Nelson	£330.9
Hawkes Bay	£390.2	Westland	£367.1
Taranaki	£351.8	Canterbury	£369.1
Wellington	£405.3	Otago	£376.4
Marlborough	£361.5	Southland	£449.5

New Zealand average £376.6

The notable features are the high incomes per head in Southland and, to a lesser extent, in Wellington and Hawkes Bay, and the low level of income in Nelson and, to some extent, in Taranaki. Sheep farming with its high investment level per person employed has long been regarded as the section of New Zealand farming which generates the highest incomes, and each of the high income provinces is predominantly a sheep-farming region. This is very true of Hawkes Bay. The presence of the administrative capital in Wellington and a relatively smaller industrial sector as compared with Auckland may also contribute to the high income in that provincial district. The very high Southland figure helps to explain, rather than is explained by, the recent rapid rate of growth of output from that area.

The low Nelson income may be exaggerated because of the failure of the estimates to take into account transfer of incomes as explained above. If, as is popularly supposed, Nelson houses many retired persons this could be quite important. However, the district also has some of the classic features of a depressed region. The 'export industry base' of the regional economy is comparatively small and the rate of growth of population of the region has been relatively slow since Nelson was founded as one of the first six colonies. The provincial district also contains the relatively depressed coal-mining and timber-milling area of Buller. In this respect it is surprising that the Westland estimates compare so favourably with national averages. The Westland figure may be exaggerated because the proportion of the value of output transferred to Nelson in correcting for differences between land district and provincial figures was too small. This could cause a slight underestimation in the Nelson figure. Taranaki is almost exclusively a dairying area and New Plymouth is too far from the main markets of New Zealand to develop into an important industrial centre. It is interesting to note that New Plymouth, Nelson and Westport, together with the centres of other relatively low income provinces, Blenheim and Greymouth, contain relatively high concentrations of industries for which low cost labour is important, such as clothing and jewellery. The decision to establish a cotton mill in Nelson is also interesting in this respect.—G. M. NEUTZE

NEW ZEALAND'S POLYNESIAN CITIZENS. Volume 70, No. 1 of the *Journal of the Polynesian Society* for March 1961 contains a very valuable series of five articles on population and migration of New Zealand's Polynesian citizens. The contributors comprise two geographers, R. G. Ward who writes on 'Population Movements in the Cook Islands', and I. Pool who discusses 'Maoris in Auckland'; a graduate of the School of Social Science, Mrs G. M. Maxwell whose article is 'Population Movement among New Zealand Maoris'; a graduate student at the Australian National University, I. Fairbairn who writes on 'Samoan Migration to New Zealand'; and a doctoral candidate at Harvard University, A. Hooper who deals with 'Migration of Cook Islanders to New Zealand'.

The series culminates in Mr Pool's timely and scholarly study of the Maori population of the Auckland urban area as a 'slightly male-dominant, residentially concentrated ethnic group' with 'unduly high proportions of late adolescents and young adults' and 'quite different demographically, from the European majority and from its rural counterpart'. He concludes from an analysis of population data that more recent arrivals located themselves primarily in central areas while the family groups spread into outer areas. The implications of these dynamic patterns must not be overlooked in the social geography of these urban areas; neither must they be neglected by the urban planner in redeveloping the central areas.

However, the Maori is but one of the Polynesian peoples in Auckland and elsewhere in New Zealand. Some of the population movements in the Cook Islands leading to the migration of Cook Islanders to New Zealand are analysed statistically by Mr Ward, while Mr Hooper gives something of the recent trends in the numbers and character of this migration. Of even greater interest will be a succeeding article by Mr Hooper, in the next number of the *Journal*, on the social organisation of Cook Islanders in Auckland. Something similar is required to follow Mr Fairbairn's analysis of the migration of Samoans to New Zealand.

These studies have appeared at a most opportune time. For those who are sceptical of the need to think and act on the problems of non-European population elements in New Zealand as well as for those who overenthusiastically take up the cudgels of this new 'mission', the series should be compulsory reading.—W. B. JOHNSTON

THE AUSTRALIAN EXPORT COAL TRADE. In recent months significant alterations have occurred in the export potential of two of Australia's most plentiful industrial minerals—coal and iron ore—as a direct result of the rapidly increasing raw material demands of Japanese industry. The relaxation of iron ore export restrictions marks the conclusion of an embargo a quarter of a century old. The completion of negotiations between Queensland coal producers and Japanese steel makers which will result in the export of one million tons of coal annually is, however, a further step in the re-establishment of an export trade with Asia that has in the past reached quite imposing proportions.

For almost one hundred years coal has been exported to India, Ceylon, Hong Kong, China, the Philippines, Malaya, Indonesia and Japan, the only complete cessation of trade occurring in the years immediately following the second World War. During this time however, marked fluctuations have occurred in its absolute and relative significance, as in direction and character reflecting technological changes (as, for example, the replacement of coal by fuel oil for bunkering purposes), competitive pricing from other Pacific-fringe coal exporters, the imposition of protective tariffs, and war. Of the major consuming nations, Japan has been an even less consistent purchaser than most, short periods of buying being separated by lengthy periods of absence from the market. This is in direct contrast to India, the Philippines, or Indonesia, whose imports reached a maximum during the early years of this century but which progressively, though irregularly, diminished, to be finally truncated (like almost all the coal export trade) by the Pacific war. The extreme irregularity of purchasing serves to emphasise the fact that at no time has Australian coal been more than a supplement to local production and other imports obtained wherever the price conditions were most favourable—a point that has immediate relevance.

In the postwar years exports were not immediately resumed, not because of a dearth of markets, but through the inability of the Australian coal industry, through strikes, inefficient and unmechanised operations and the production of a fuel greatly varying in thermal characteristics, adequately and regularly to fulfil even domestic requirements. Since then, however, planned development and rationalisation in the black-coal industry has ordered the former chaos to the point where a now reduced domestic market can no longer consume all the coal produced. To minimise the effects of this surplus productive capacity attempts were made to regain some of the export trade, and this led to some resumption of sales, mainly to industrialising but fuel-deficient Asian nations, especially Japan, but also to Hong Kong, Korea and Malaya.

In eight years export sales have been built up to their highest level since the early 1920's, the result almost entirely of rapidly-expanding Japanese consumption, which between 1959 and 1960 doubled to a record 900,000 tons. In 1960, 345,000 tons of Bulli seam hard coking coal were exported from the Illawarra scarp mines to Japan through Port Kembla, and a further 165,000 tons from the same seam were taken by road from the Burragorang Valley to Sydney for shipping. In addition, 325,000 tons of soft coking, gas making and steam coals from the Newcastle, Cessnock and the Northwestern field were shipped from the port of Newcastle. Although these are record tonnages, they do not represent an upper limit, for it has been estimated that by the mid 1960's these figures will have substantially increased to about three million tons *in toto*, mainly from the Illawarra and Burragorang mines.

The ramifications of the resumption of coal exports are wider than the simple sale of one or two million tons annually, with the consequent slight increase in export earnings. New producing areas have been developed, individual mines have undertaken extensive modernisation programmes involving heavy capital expenditure, while transport and transhipping facilities have been constructed or radically altered. Most significantly, recent agreements have spread these benefits over two states, thus breaking the hegemony of New South Wales in the same way as that of the Northern fields within New South Wales was broken, first by the Illawarra, then by the Northwestern and Southwestern fields.

At no time in the past has Queensland, despite its vast coal resources, been able to gain more than a minute section of the oversea coal trade. Small, mostly unmechanised mines, working coal of a high and variable ash content have concerned themselves almost entirely with supplying domestic and, on rare occasions, interstate markets. From time to time the coal deposits at Blair Athol and elsewhere have been considered for the export trade, but disadvantageous location involving a 250-mile rail haul before shipment from Gladstone would seem to have militated against successful exploitation despite the physical advantages of the deposit, particularly the great thickness and proximity to the surface which permit opencut mining, and the relative locational advantage of Gladstone over southern ports for the Asian trade. Recently however, trial shipments of up to 30,000 tons at a time have been made to Japan from the Kianga field (130 rail miles southwest of Rockhampton), where intensive prospecting and drilling have been carried out over a wide area in the hope that within this field, whose character varies greatly from place to place, sufficiently large quantities of coal suited to the production of metallurgical coke might be found to warrant the completion of long-term contracts.

The agreement to accept a million tons annually for five years marks the successful outcome of these searches and thus the commencement of coal winning, restricted under the terms of the franchise granted by the state government to supplying the export trade. Furthermore, to facilitate haulage to Gladstone, 100 miles of railway is to be constructed and rolling stock purchased with capital provided by the Japanese buyers, all ultimately reverting to the Queensland Government. Such investment should, in conjunction with a ban upon production for local consumption provide ample incentive for obtaining new markets or the extensions of present contracts, but this will depend upon the ultimate suitability of the product in terms of quality and price. An estimated eight-percent ash content allied with opencut methods of operation augur well for the future of the scheme at this stage, however.

For the black-coal industry of Australia, export prospects seem favourable. To meet the special needs of this market, problems of haulage and quality control are being examined. Bulk-handling equipment at all ports is being, or is about to be, renewed or improved, often in conjunction with overall port reconstruction as at Port Kembla and Newcastle, while collieries are improving their coal washing and cleansing facilities. Nevertheless, this future cannot be regarded with unqualified optimism. The specific quality demands of the export trade necessitate careful re-evaluation of reserves in New South Wales, for Bulli seam coking coal which constitutes the bulk of the exports is that coal most widely used in the developing Port Kembla iron and steel industry, while the four-percent ash gas coal, the best available from the Cessnock field, is restricted in reserves to only a few years' supply. Prolonged exports of the magnitude proposed will depend upon the rate of reserve depletion and domestic consumption patterns as much as on continued Japanese demands. In Queensland, however, reserves are large and specialised consumers at present unimportant. It is possible therefore that future developments in that state may relieve the well developed New South Wales fields of this conflict of interests.

In the broadest view this large and apparently continuing increase in the Asian coal export trade has materially assisted in the re-establishment and maintenance of the coal industry at a high and efficient level of production in the face of severe competition from brown coal and petroleum products on the domestic market. While exports have still some distance to go to rival the boom years of the early twentieth century when exports exceeded two million tons annually, the rapidity of expansion is such that this should be reached and even surpassed in the next few years. By this time it is expected that exports will constitute approximately one eighth of total production, a worthwhile addition to coal mined for the domestic market, though in view of its importance as a stabilising influence in the industry, possibly a dangerous one.—M. G. A. WILSON

THE BRISBANE CONFERENCES. At the end of May and the beginning of June two congresses were held in Brisbane—that of the Institute of Australian Geographers from Friday 26 May until Monday 29 May, and that of the Australian and New Zealand Association for the Advancement of Science from Monday 29 May until Friday 2 June. The overlap of one day between the meetings of the I.A.G. and Section P of A.N.Z.A.A.S. produced a series of joint sessions, although the first part of the Monday morning was taken up by the General Assembly of A.N.Z.A.A.S. This meeting was notable for the move made to exclude New Zealand from the association—a move of which most New Zealanders attending the congress were officially unaware, and a move which seemed to have little virtue in the light of the very small attendance of representatives from Western Australia. Suffice to say that strong protests by New Zealanders present were sufficient to prevent immediate action on this question.

The meeting of the I.A.G. was the second formal conference held by the institute, the first having taken place at Melbourne in January 1960. Eleven papers were read, including both the address by the incoming president of I.A.G., Professor O. H. K. Spate, and the presidential address by Professor Peter Scott to Section P of A.N.Z.A.A.S. One third of the remaining nine papers was devoted to geomorphological studies in Central Australia, the West Kimberleys and the Australian Alps; another third comprised papers based on quantitative analyses in commodity flows, future employment structures and the Australian workforce; and three contributions were made on dairying in coastal New South Wales, vegetation studies in forest-fire areas in South Australia, and some aspects of native agriculture and settlement in Kenya.

The programme of Section P began with Professor Scott's presidential address, 'Approach Levels in Agricultural Geography', which will be published in the *Australian Journal of Science*. Other papers on agricultural themes were those on commercial viticulture in South Australia, the application of Thornthwaite's concept of potential evapotranspiration in the New South Wales wheat belt, the pattern of recent beef-cattle movements in Central Queensland, and two methodological contributions dealing with a geographical approach to land-use studies and their application, and land-cover mapping in the Hunter Valley. Three symposia were conducted on the recent mapping of Australia, on the number of people that Australia can support, and on the conservation of natural resources. That on population in Australia was particularly well supported and was marked by a warmly-received contribution by Professor Griffith Taylor.

Problems of Pacific islands did not go unnoticed. One paper outlined postwar development in the Goroka Valley, New Guinea, another raised the question of the diversification of Fijian agriculture, while a third discussed the sugar industry in Fiji. A fourth contribution, that on population, production and self-government in Western Samoa, was not read. Two papers only were concerned with physical geography as such, one on the origin and history of Lake Michigan and another on the mode of development of stepped erosion surfaces.

Both conferences were extremely successful, although the strain of seven days of meetings and discussions did suggest that, in future, the I.A.G. should meet at times other than those chosen by A.N.Z.A.A.S. Nevertheless, the personal contacts renewed and made, and, for a New Zealander, the opportunity to appreciate some of the problems in geography in Australia and to visit departments of geography in the universities, more than compensated for any difficulties in this respect.

It was particularly unfortunate that the day set aside for the excursion arranged by Section P proved so disappointingly wet. The trip through the northern suburbs of Brisbane, the 'wallum' country and the Glass House Mountains to the pineapple, banana and sugar growing areas around Nambour was admirably conceived. In fact the organisation of both conferences was extremely efficient, and to the people concerned in the Department of Geography, University of Queensland, the thanks of everyone are due.—JAMES W. FOX

SOUTHEAST ASIAN CONFERENCE. At Kuala Lumpur from 2 to 23 April next year a conference is to be held which will aim 'at focusing attention on geographical themes of immediate relevance to Malaya and Southeast Asia, thereby providing data for assessing past practices and future policies in the region and the humid tropics generally'. It is hoped that geographers, geologists, meteorologists, foresters and agriculturalists from countries in Southeast Asia and from those interested in Southeast Asia will attend, together with delegates from international organisations like FAO and SEATO. Professor C. Troll, the President of the International Geographical Union, has been invited to the conference, which is sponsored by both the union and the University of Malaya, and it would be fitting if Professor K. B. Cumberland, Vice-President of the I.G.U. were able to be present from New Zealand.

Two attractive tours are scheduled, and five sessions which embrace climate and meteorology, geology and mineral resources, agriculture and land use, population and ethnic studies, and urban geography have been organised. If sufficient support is forthcoming three other sessions will be held in cartography, historical geography and the teaching of geography. Papers to be presented in all these sessions should be received by Professor Robert Ho of the Department of Geography, University of Malaya, Kuala Lumpur, by 1 March 1962. All correspondence relating to the conference should be addressed to Professor Ho.

IN OUR CONTEMPORARIES

1. *In New Zealand Journals . . .*

Agriculture in the North Island

STUDIES IN FARM MANAGEMENT: WAIRARAPA INLAND HILL COUNTRY: F. G. Spite, *N.Z. Journal of Agriculture*, Vol. 102, No. 1, January 1961, pp. 57-63;
STUDIES IN FARM MANAGEMENT: AN EGMONT COUNTY FARM: G. R. Moss and A. C. Burgess, *ibid.*, Vol. 102, No. 2, February 1961, pp. 177-187;
STUDIES IN FARM MANAGEMENT: HAWKES BAY HILL COUNTRY SHEEP FARM: F. H. Collin, *ibid.*, Vol. 102, No. 3, March 1961, pp. 265-276.
STUDIES IN FARM MANAGEMENT: A PIAKO DAIRY FARM: S. D. Clay, *ibid.*, Vol. 102, No. 4, April 1961, pp. 369-377;
STUDIES IN FARM MANAGEMENT: DEVELOPMENT OF A WAITOMO PROPERTY: W. L. Osborn, *ibid.*, Vol. 102, No. 5, May 1961, pp. 419-424;
STUDIES IN FARM MANAGEMENT: MANAWATU SAND COUNTRY FAT-LAMB FARM: J. A. Graham, *ibid.*, Vol. 102, No. 6, June 1961, pp. 506-514.

For many years now the *New Zealand Journal of Agriculture* has published studies in farm management which serve to emphasise some of the more significant features of the regional geography of the dominion. Eight have appeared recently in successive numbers of the journal, two late in 1960 dealing with a farm on the Coromandel Peninsula and another on the Volcanic Plateau in Waimarino County, and six in 1961. These last are the subject of the present review.

Mr Spite describes in detail a one-man 1,300-acre farm in the northern hill country of the Mauriceville and Eketahuna Counties, and in so doing not only deals with one of the lesser-known areas of the Wairarapa, but shows clearly how one man's initiative and hard work have in fourteen years made an economic holding out of what, in the beginning, seemed a hopeless proposition. Three hundred acres have been regrassed, cocksfoot being dominant in the pastures which today carry a ewe flock of 1,300 and a herd of 75 breeding cows. Problems overcome, and those remaining, of climate, soil infertility, distance from markets, and erosion on steep slopes of greywacke and mudstone, are all associated with much of the Wairarapa inland hill country.

The 224-acre dairy farm outlined by Messrs Moss and Burgess lies inland from Oaonui in Egmont County on land where volcanic hummocks are a common feature of the landscape. Volcanic ash covers large boulders and stones of an earlier eruption. Many of these hummocks have been bulldozed, although grass growth is never very vigorous after this treatment. Improvement on this Taranaki farm has largely been due to the introduction of shelterbelts of *Pinus radiata* and eucalypts against the very strong sea winds of the area. Moreover, fifteen miles of drains have been made. Today the farm can run 140 cows in milk, and farm statistics in respect of butterfat are most encouraging. These show a rise from 6,400 lb in 1920-1921 to 43,000 lb in 1958-1959. The target is 60,000 lb.

On the half million acres of steep to undulating hill country of the western foothills of Hawkes Bay, with problems of fern and scrub, poor pastures and terrain marked by deep gorges, all farming is difficult. Mr Collin gives details of one typical 1,254-acre property 27 miles northwest of Hastings. The present farmer has been developing this land, 1,100 feet above sea level, for the past thirteen years. Before he took it over, 100 acres were practically useless, 580 acres were very inferior in terms of cover, 215 were in native grasses, 229 in fern, and 230 almost barren. From this unpromising start the farmer has been able so to improve the holding that now only 547 acres are not in good pasture or choumoellier. In order to achieve this he has had to rid the property of rabbits, topdress extensively, and adopt a stock policy moulded to the subterranean-clover-dominant pasture which produces a flush of growth in autumn and spring but little during the rest of the year. Present stock on this farm are 3,450 sheep, mainly Romney-cross, and 224 cattle. Wool production for 1959-1960 reached 44,019 lb. Mr Collin describes stock and land management, showing how earlier reliance on choumoellier as a winter feed is not now so necessary. Special-purpose pastures are a feature of the property, being used for fattening cattle in summer, for wintering sheep, and in autumn for the prevention of ill-thrift among hoggets.

Mr Clay provides a clear picture of farming in swamp areas where the clearing of stumps and draining are the main problems. He takes as an example a 101-acre Piako farm near to Matamata. This particular farm has two distinct soil types divided by a terrace. On one side is the Waihou sandy loam, yellow-brown in colour, and on the other, fifteen feet lower, lie the meadow soil pastures on Waitoa silt and sandy loam. The former have responded well to phosphates and now to potash. The meadow soil requires drainage, as would be expected, but the principal difficulty is that field tiles do not function well here as the subsoils are so impervious that water will not move laterally. Since 1947 one of the biggest tasks undertaken by the owner has been to tackle the swamp. Each year an additional section has been cleared and drained. Mr Clay gives a chronological account of stock management, and figures from this show a fat-per-acre rise from 162 lb to 338 lb in ten years.

From the King Country, an area which is rapidly changing, Mr Osborn writes about a Waitomo County property of some 673 acres at Puketutu, twelve miles south of Te Kuiti. Although for nine years there has been continuous hard work and considerable capital investment in connection with this particular farm, there are still 138 acres in heavy bush, and 35 in swamp and gully, so that the effective grass acreage is 500. Mr Osborn emphasises the principal difficulties of steep terrain, grass grub, ragwort and fireweed, and difficult fencing. He shows plainly that the development programme has meant endless hard work for the owner who has employed labour twice only and for very short periods. The fact that for the past two seasons the lambing percentage was 120 compared with 90 to 95 in the district is a tribute to this hard work and careful stock management.

Agriculture on sand country is difficult. Mr Graham writes of a Manawatu fat-lamb farm which shares many of the common problems of the whole area from

Paekakariki to Patea. The farm studied covers 243 acres and is situated south of the Rangitikei east of Tangimoana. The soils are all sandy with the exception of those derived from a few small areas of peat. This farm has been developed for seven years and when it was taken over, as Mr Graham points out, the whole area was poor pasture and native grasses. Rushes were thick in the less well drained sections. The questions of drainage and of water supply had to be considered first. The sandy soil does not permit the use of tiles or moles, so broad V-shaped drains, which remove surface water only, have been used. Some good photographs indicate what the property originally looked like in terms of reverting pasture through lack of drainage. The problem of water supply has been solved by pumping directly by a high pressure pump to the front paddocks while the troughs in the back are gravity fed. Mr Graham considers impressive the results of the work done on this farm during the past seven years, and in support of this he quotes figures. In 1953 sheep carried were 700 ewes plus a few rams, in 1960 the numbers had increased to 1,040 ewes, 20 rams, 50 hoggets and a varying number of cattle each year.—RILDA GORRIE

CHANGING MAORI AGRICULTURE

THE MAORI AGRICULTURE OF THE AUCKLAND PROVINCE IN THE MID-NINETEENTH CENTURY: R. P. Hargreaves, *Journal of the Polynesian Society*, Vol. 68, No. 2, June 1959, pp. 61-69;

MAORI AGRICULTURE AFTER THE WARS: *ibid.*, Vol. 69, No. 4, December 1960, pp. 354-367.

In these two well-documented papers, Mr Hargreaves applies geographical methods to the analysis of successive phases of Maori agriculture in transition from the pre-European to the contemporary economy. The first article focuses on agriculture in the Auckland Province in the pre-Maori War period when a combination of inherent skill and eagerness, missionary and governmental influence, and favourable market conditions produced pockets of neat productivity among much that was—at least to pakeha eyes—anachronistic and disorderly. These latter characteristics were evident in the widespread practice of shifting cultivation, lack of fertilisation, weed-infested fields, poor seed and livestock selection, and lack of sensitivity to market requirements. The selection of crops had changed, native crops other than kumara and some taro having been abandoned—and it could well have been added that the yams alluded to had disappeared shortly after Cook's visits, and that the common kumara and taro as likely as not belonged to pakeha varieties. Potatoes and maize, oats and wheat, tobacco and fruit trees were generally adopted, oxen and ploughs assisted in tillage, and Maori mills ground flour which, with admittedly uncertain success, supplied a growing Auckland market, and the Waikato saw solid achievement. Yet success was partial and precarious; the campaigns of the 'sixties precipitated rather than caused the end of an already waning industry, and the Maori people were already turning to less exacting and more lucrative employment.

In his second article, Mr Hargreaves centres attention on the postwar period and extends his analysis to the whole country. The period was less happy for the Maori farmer; similar crops were grown but the cultivated area had contracted drastically and the effects of agricultural malpractices were, if anything, more evident. The prevalence of crop and livestock diseases, the poor quality and declining quantity of production, the virtual cessation of flour milling as well as the marketing of pork and potatoes were but some of the symptoms of deeper problems. European observers—not always without ulterior motives—charged much to the communal landholding system, but other factors such as restricted and unsuitable lands, greater immediate economic rewards for other activities, including renting and selling of land, and the profound disillusionment of the postwar period were equally involved in the general failure to match the progress of the pakeha.

Yet the period was not without achievement. Careful tillage was sometimes evident, new experiments such as hop-growing were conducted, fencing had improved, and implements such as the plough were more widely adopted. Some government aid and comfort was available to develop mechanisation, supply better seed and inform the farmer, but by and large the picture was depressing. European competition was driving Maori produce from the markets, and the Polynesian was retreating from incipient commercialisation to subsistence agriculture combined uncertainly with wage-labour.

But this retreat was not everywhere evident, as is made clear in the mapping and description of 'agricultural regions' of 1886. This summary of areal variation reveals that the focus of relatively progressive agriculture had shifted from the former fruit-and-grain growing centre of the Waikato to the coastal zone flanking East Cape. But the 'agricultural regions' appear to be constructions based on the degree of Europeanisation rather than on the constituent elements of agriculture. Only thus can the delineation of a region extending from North Cape to the Bluff possibly be justified. The recognition of regions is notoriously subjective, yet a selection of other criteria such as the actual complexes of crops and livestock would perhaps have resulted in a more meaningful subdivision. The relative significance of kumara and potato, maize, wheat and oats, tobacco and fruits certainly varied within this latitudinal range, and maps of the distribution of wheat and sheep suggest some degree of recognition for Hawkes Bay and western Wellington respectively. Nor do the data on crops, livestock and agricultural practices, presented in a somewhat matter-of-fact and perhaps disconnected fashion, readily fuse to clarify the relationship between these elements, and give a coherent impression of the living actuality of Maori agriculture and the social and physical forces which were shaping its evolution—a lack which is partially removed by the description of the Rangiaowhia settlement in the earlier article. But such omissions are at least in part consequential upon the paucity and unevenness of data. Mr Hargreaves has done valuable service not only to the cause of historical geography but to all who are interested in the themes of Maori life and culture change in the New Zealand setting.

—G. R. Lewthwaite

2. *In Oversea Journals . . .*

THE REGIMES OF NEW ZEALAND RIVERS

LE RÉGIME DES RIVIÈRES EN NOUVELLE ZÉLANDE: Maurice Pardé, *Revue de Géographie Alpine*, Vol. 48, No. 3, 1960, pp. 383-420.

This article has much in it of interest to the New Zealander whether he be concerned with rivers in particular or with the landscape in general. Pardé's approach is that of a hydrologist, examining in a logical succession the characteristics of New Zealand rivers—their floods and the probable reasons for them, their mean annual discharges, their seasonal variations in flow; their minimum discharges; and the erosion and transport that they accomplish. Pardé has not visited New Zealand, and his study and deductions are based entirely on published material. This, as he points out, is limited in amount, and it is evident that he may well have made in all good faith errors which will be immediately apparent to those familiar with the areas of which he writes. Nevertheless, this article is of considerable value as an example of an exercise in logical deduction from a limited number of facts, supported by an expert knowledge of the field of study.

Among the methods by which Pardé amplifies his information is the comparison of New Zealand rivers in all their aspects with those overseas. It is probably insufficiently realised in this country and elsewhere, how exceptional most New Zealand rivers are. Their nearest equivalents are probably to be found in the Mediterranean regions of Europe, where the Lot, Durance and others display similar broad, aggraded valley floors and braided streams. Even here the parallel is not close, however. Certainly, rivers resembling those of New Zealand are not to be found in Scotland and Norway, where, Pardé claims, similarities of relief and rainfall would seem to imply similarities in behaviour of rivers.

The apparent similarity with conditions in Norway and Scotland initially suggested to Pardé that floods in New Zealand rivers would be of the same order as those in two northern countries, that is, not of great magnitude, nor normally disastrous. New Zealand rivers, however, are very prone to disastrous flooding. Pardé employs a coefficient of maximum discharge for comparative purposes, as follows: A Q S where Q is the maximum discharge at a given point in metres per second, and S the surface of the catchment area in square kilometres. An examination of the values obtained for A for New Zealand rivers reveals a range of 16 (for the Waikato at Mercer) to 195 (for the Haast River). The majority of rivers—nineteen of the twenty-nine for which figures are available—show values of 80 to 160. A comparison with figures for rivers elsewhere demonstrates that floods in New Zealand exceed those of many European rivers at their most disastrous; for example 60 for the Agout and the Tarn, and 70 to 75 for the Garonne, during particularly serious floods. Figures corresponding to those in New Zealand, namely 125–150, are found for rivers of Mediterranean areas, amongst others the Ardèche, and the Gardon, in the Cevennes. Higher figures are recorded in Japan and Texas, reaching values of 200–300.

Examination of the New Zealand figures shows that most rivers subject to severe flooding are to be found in the North Island, notably those flowing into Hawkes Bay. Thus the Wairoa on 15 May 1948 gave a value of 186.6 for A, while a value of 181.5 is found for the Mohaka in April, 1938. Other North Island rivers give figures which, if not so high as those quoted, are nevertheless impressive. In the South Island figures for Westland rivers are of a similar order of importance. Rivers whose flow is to some extent regulated by lakes, such as the Waikato, the Waitaki and the Clutha, yield much lower values for A—and in the case of the Clutha it seems probable that Lakes Hawea, Wanaka and Wakatipu reduce flooding by about fifty percent. Even so, the values obtained for these rivers are appreciably above figures obtained for European rivers draining areas of comparable size. The New Zealand rivers serve to demonstrate that a well distributed rainfall does not mean that flooding is unlikely, as is too often assumed. In contrast to Norway, Scotland and southern Chile, in New Zealand severe flooding is associated with a well distributed rainfall.

A further factor determining the character of New Zealand rivers, apart from their floods, is that of their mean annual flow. This is expressed in terms of litres per second for each square kilometre of the catchment area. Records exist for only sixteen rivers, all of which flow through lakes, but the figures are nevertheless significant, especially when compared with European examples. In the South Island, in the Waitaki catchment area, 97 lit. per sec. per sq. km. are recorded for streams entering Lake Pukaki, 59.3 for Lake Ohau, and 5.6 for Lake Tekapo. To the south-east, where Lakes Te Anau and Manapouri are less sheltered from northwesterly air masses than the three already cited, figures are 80.3 for Lake Te Anau, and 83.5 for Lake Monowai. These figures are compared with those for some European rivers: 30 lit. per sec. per sq. km. for the Rhône at Lyon, 42 for the Reuss and the Limmat in Switzerland, but only 14 for the Saône and 7 for the Seine at Paris. Values of 70-80 are rare in Europe outside Norway, occurring only in certain small mountain basins in the Alps, and for somewhat larger areas in Scotland. Higher values are found in Norway with 160 lit. per sec. for the Norddalselv south of Nordfjord. Values at least as high may be found in western North America, and even higher figures (180-225 lit. per sec.) in southern Chile.

In spite of the uncertainty necessarily involved in this study, it becomes apparent that one of the more significant characteristics of New Zealand rivers is their relatively small variation in flow, as demonstrated in the mean monthly discharges, and in the relation of these to mean maximum and minimum discharges. There are not wide differences between the average monthly discharge and the minimum discharges of most rivers, as compared with the variation in flow experienced by many European rivers. It results, Pardé suggests, from the abundant annual precipitation, which ensures that, even where summer evapotranspiration is high, a considerable quantity of water is still available to maintain a high monthly discharge rate in the rivers.

The concluding section of this paper considers the erosive power of the rivers, the load transported, and the nature of the beds. Much of this will not be new to New Zealanders. Perhaps less generally known are the figures quoted for amounts of solid matter transported in suspension and such information as Pardé has found reveals that in this respect also New Zealand rivers are as efficient as any in the world. In the flood of April 1938 the Esk carried 460 kilogrammes of solid matter to 1000 kilogrammes of water. In a period of twenty-four hours this would amount to about forty million metric tons carried from the catchment area, excluding the heavier boulders and pebbles carried along the bed. This is more than the mean annual amount carried by such rivers as the Rhône and the Po. Other rivers in New Zealand may not carry such staggering quantities, but still carry amounts of nine to ten million metric tons in similar short periods.

The heavy traction load is reflected in the aggraded character of the river beds, with their braided streams and generally rectilinear pattern. Such features Pardé regards as the result of unbalanced erosion with overproduction of gravels. Narrow river beds of low gradient and formed of fine materials with meandering streams are rare in this country. Such have existed, only to be changed into the typical gravelly bed over a relatively short period of time, as in the case of the Manawatu River.

—Jane M. Soons

Little-Known Resource of Little-Known Islands

DIE MUTTONBIRD ISLANDS: Ulrich Schweinfurth, *Erdkunde*, Band XV, Lfg. 2, 1961, pp. 110-121.

Ulrich Schweinfurth of the Institute of Geography, Professor Carl Troll's department in the University of Bonn, spent a year in New Zealand to continue in the Southern Alps the studies of the plant geography of high mountain regions which he had previously pursued in the Himalayas. This remarkably interesting essay on the geography of the islands off Stewart Island is an appealing by-product of his major work. As the German author hints, the geography of muttonbirding in New Zealand is more likely to attract the interest of a visiting geographer than one of the Kiwi breed. Since this has proved to be the case geographers will be all the more grateful to Dr Schweinfurth for his concise and colourful study of out-of-the-way parts of the country and of a little-known industry.

His account of the sooty shearwater (*Puffinus griseus*)—'several millions' of which breed in New Zealand each year—its requirement of deep peaty soil for its nesting burrows, its carefully regulated daily habits, its massive sunset landing operations and the casualties that occur in the thick scrub of the islands it frequents, and the effect of its droppings on vegetation and of its burrows on drainage and water relations, makes an admirable piece of geographical writing.

The numerous islets about Stewart Island are divided into three groups for geographical study, and their plant geography is examined in some detail. The cultural significance of the sooty shearwater—past and present—is analysed in an important and concluding section of the article headed 'Das Muttonbirding'. Here attention is given to the inherited and carefully guarded rights of the Maori families concerned, to the preparations for their annual fowling operations (the manufacture of kelp-sacks and the processing of *Phormium*), and to the departure of the muttonbirders to the islands in mid-March—no longer in canoes but in Bluff fishing vessels. The 'season' lasts from the first of April to the thirty-first of May. The Maoris first take the fat young birds from the burrows; later they are hunted at night with torches when the young birds begin to leave the less accessible nesting holes in May. After being dipped in hot water and having their head, wings and legs removed, the birds are packed in kelp. They are marketed 'fresh', or salted, or cooked (and preserved in their own fat). The annual catch totals more than a quarter of a million birds. But the supply is not sufficient to meet the growing demands of Maori consumers. Today therefore the Auckland market is supplied by importing from Tasmania in casks more than 200,000 salted mutton birds of a related species (*Puffinus tenuirostris*).

Dr Schweinfurth's essay is more particularly welcome at this juncture because muttonbirding is in decline. Fowling on the stormy southern islets is a dangerous occupation and carried on in isolation. In an era of affluence and full employment it is no longer a preferred form of economic activity and there are no signs in New Zealand yet of the introduction of the more modern methods of economic exploitation found in Bass Strait. To which the conservationists will no doubt say 'Amen'.

—Kenneth B. Cumberland

New Zealand for German Schools

NEUSEELAND: Walter Schurig, *Geographische Rundschau*, Jahrgang 13, Heft 2, Februar 1961, pp. 45-46.

Dr Schurig of Lübeck spent some time in New Zealand several years ago and subsequently wrote in German a brief essay on the urban geography of Kaikohe. He has now prepared and published for teachers of geography in Germany a brief summary of the physical and economic geography of New Zealand. In the absence of any other articles on New Zealand in postwar issues of academic journals of geography in Germany (except Dr Sellenberg's recent review of the pastoral industries) this little pen picture will be welcome.

It contains, however, nothing new. It is but a concise summary in translation of statements on the systematic geography of the dominion appearing in standard New Zealand school textbooks, together with an introductory section, which repeats the fanciful Polynesian traditions of the origin of Te Ika a Maui and of the arrival of the fourteenth-century canoe fleet, and briefly describes the pre-European geography of Aotearoa Maori. It provides no hint of human settlement before 1350 A.D. It has for European teachers a useful list of references, although both they and some of the economic and demographic data, are now six or seven years out of date.

—Kenneth B. Cumberland

REVIEWS

Bases of Industrial Growth

NEW ZEALAND'S INDUSTRIAL POTENTIAL. Edited by R. Gerard Ward and Marion W. Ward. Auckland: New Zealand Geographical Society, Auckland Branch, 1960, pp. 184, 10s. 6d.

Faced as the country is with the fears and prospects aroused by Britain's proposal to join the European Economic Community, the decision of the Auckland Branch of the New Zealand Geographical Society in 1960 to arrange and publish this series of lectures delivered to the branch appears in 1961 even more pertinent. The volume contains many facts, and a few opinions, that are essential to formulating a policy for continued and diversified industrial growth, and those interested in the subject will be especially thankful for the large number of tables, graphs and maps which concisely set out this basic information—information which, as most will agree, is only laboriously gathered together. In fact these data, and some of the maps (not all are well produced) probably represent for the person who closely follows industrial matters the most useful part of the publication, for in truth the text contains little information that is new. This is no disparagement, for the lectures are excellent and informed summaries, which among other things will ensure their popularity amongst undergraduates. Wisely, however, the editors have considered the needs of the non-specialist and have included, where necessary, useful definitions of technical terms or elaborations of technical points.

The topics covered include the mineral and power resources of the dominion and the conditions in, or prospects for, basic industries like forest products, petroleum, aluminium and iron and steel. Attention is paid to the significance of the consumer-goods industry as a field for the employment of the increasing labour force and as a means of conserving oversea earnings. The more human aspects of industrialisation, with particular reference to the Maori, are also dealt with, as is industrial development in the most important of manufacturing centres, the Auckland metropolitan region.

The publication makes no pretence of being a complete survey, but it is revealing to note some of the items that have been omitted, the inference being that these topics invite research and investigation. Nothing is said about transport in New Zealand, though it is obvious from J. S. Watt's account of a possible iron and steel industry that high transport charges will strongly influence the choice of site. A second notable omission is the absence of any discussion of the scale, organisation and control of industry, even though in the last decade the role of large and powerful oversea corporations has increased significantly in New Zealand's industrial affairs and in the very industries, petroleum, forest products, aluminium and iron and steel, treated. Perhaps only an economist could have dealt with this subject, and possibly one was not available, for economists who show a real interest for, or belief in, industrialisation are rare in New Zealand. Quite indicative of the progress made towards industrialisation and of the essentially technocratic basis of this trend, is the fact that all of the three speakers drawn from large private industrial organisations had received a university training, and to an advanced postgraduate level. The other contributors were drawn from the universities, public bodies and government departments. If any evidence is required of the importance of high levels of academic attainment and advanced training to the country's future industrial development, then this publication may be considered as a valuable exhibit.

Disappointingly however the speakers follow an insufferable New Zealand tradition of not using their specialised knowledge as a basis for intelligent criticism, which is vital to the formulation of sound public opinion. No one outside the country having read the account of New Zealand's power resources would be aware of the muddle (and the accompanying ministerial *volte-face*) which has beset the planning and development of these resources. Nor would they be aware, from the account of the consumer-goods industries, of the elementary stage at which the promotion of industrial exports now stands; or of the huge change in attitude and thinking throughout society which is required if, as is suggested, industries that require a high degree of skill are to be prominent in the plans for industrial development. Finally, they would not appreciate that the appeal for a more rational and planned development policy both at the national and regional level, with which the Regional Planning Officer of the Auckland Regional Planning Authority concludes his lecture, has been made at some conference or other every year during the last decade, with comparatively little effect. Conspicuously absent from all of the talks is a note of urgency.

The publication, which is the third in the Miscellaneous Series of the Society, and the second Branch Publication, is a good indication of the problems with which New Zealand industry is faced. Like many New Zealand industrial products, the publication meets a real demand, in good time, and at a price with which no one can quibble. But it is a most graceless publication, the fault of neither the editors nor the branch, but of the attitudes so widely abroad in the manufacturing sector in this country.—S. H. Franklin

Elements of Industrial Location

INDUSTRIAL ACTIVITY AND ECONOMIC GEOGRAPHY. By R. C. Estall and R. Ogilivie Buchanan. London: Hutchinson, 1961, pp. 232, 12s. 6d.

The authors of this 'introductory essay of limited size' state early in the text that they have made 'no attempt to provide a comprehensive economic geography of manufacturing industry'. Rather, what they have set out to do is to write 'a first approach to an understanding of the conditions that affect the *location* (*sic*) of industrial activity'. They indicate that little of the book is the result of firsthand investigation, but that it is an attempt to cull material from a wide range of sources so made more readily accessible to students.

The plan of the book is quite simple. The first eight chapters combine discussions of the influence on industrial location of such factors as materials, transfer costs, labour, capital, and so forth, and these points are drawn together in the final two chapters devoted to three individual industries, namely, iron and steel making, motor-vehicle manufacturing, and oil refining.

The authors do not set out to establish new principles or present new ideas, but they have succeeded in weaving together the results of a large number of studies in a most interesting and readable way. There has been a very real need for a book of this kind which can be used as a jumping-off point for more advanced reading, many references to which are noted at the end of each chapter.

Even bearing in mind the declared aims of the authors, however, the allocation of space between the various parts of the analysis is somewhat surprising. For example, only 25 pages are devoted to 'materials, markets and transfer costs in industrial location' whereas 31 pages are given over to a discussion of 'energy sources and industrial location'. Again, although the authors recognise 'the existence of two levels in the location decision—the broader regional level and the narrower local level. . . .', they give scant attention to the second of these. A discussion of intraregional factors should have merited one complete chapter to itself even though it can be agreed that 'the line of division between these two levels of decision is not always clearly defined'. A more detailed discussion would have enabled the authors to draw on work concerned with the location of manufacturing in towns and, in particular, the growth of factory industry in the outer suburbs. Such studies as Gordon Logie: *Industry in Towns*, London, 1952; and Edgar M. Hoover, Raymond Vernon, *et al.*: *Anatomy of a Metropolis, The Changing Distribution of People and Jobs Within the New York Metropolitan Region*, Cambridge (Mass.), 1959 could then at least have been noted. As it is, Chapter 7—which begins by discussing intraregional factors—devotes only half as much space to these as to 'water' and 'climate'.

Most of the examples mentioned in the book are taken from the British Isles or the United States. New Zealand is not mentioned once, and Australia only two or three times. It is to be hoped that when students in these countries are recommended to read this book they will, at the same time have their attention drawn to the many situations in Australia and New Zealand which illustrate very well the factors discussed in it.

These comments on its emphasis do not detract from the very real value of this book which deserves to become required reading for all students of economic geography, whatever their particular specialisations within this field, and to have a prominent place on the bookshelves of their mentors.—G. J. R. Linge

Master Methodologist

ALFRED HETTNER, 6-8-1859: GEDENKSCHRIFT ZUM 100 GEBURTSTAG. Edited by G. Pfeifer. *Heidelberger Geographische Arbeiten*, Heft 6, 1960, pp. 88.

Edited officially by Gottfried Pfeifer, who now holds Hettner's former chair at Heidelberg, but largely written and designed by Ernst Plewe, Director of the Geographical Institute of the Wirtschaftshochschule at Mannheim and possibly Germany's foremost contemporary historian of geography, this tidy, concise biography is an extremely useful little volume. It consists of a short introductory greeting and three principal addresses given at the Heidelberg University commemoration of the centenary of Hettner's birth; three autobiographical sketches by Hettner —one a brief outline of his life, one on his scientific work and objectives, and one from a letter to Joseph Partsch; and a complete bibliography of Hettner's work compiled by Plewe.

Most important is Plewe's address: 'Alfred Hettner, seine Stellung und Bedeutung in der Geographie'. Though not as easy to read as Hettner's own writing, this essay is a model which in less than twenty pages provides a succinct account of Hettner's training, travel and writing and, above all, a balanced assessment of his particular contribution to geography and a critical estimate of his place and standing.

First of his kind, Hettner sought, in a period of methodological confusion in German geography, to train and equip himself as a geographer. Early in his career it became his aim to rescue geography from its confusion. He studied under many heads of new university departments of geography: Kirchhoff (the philologist) at Halle; Fischer at Bonn; Gerland (another philologist) at Strassburg, where he worked on the climate of Chile; von Richthofen (the geologist) at Bonn; and Ratzel (the pharmacist and foreign correspondent) at Leipzig, where he completed his inaugural dissertation: 'Der Gebirgsbau der Sächsischen Schweiz'. Meanwhile he travelled widely, especially in South America.

At this stage he had the choice of becoming either a South American specialist or of undertaking to set the whole field of geography on firmer foundations. He chose the latter; and the opportunity presented itself with the founding of the *Geographische Zeitschrift* on which, as editor, Hettner imposed his personality and views for forty years. Ritter and von Humboldt had provided much stimulus for the study of geography, but they had bequeathed a methodological situation which was perplexing and uncertain. Meanwhile the discipline was in the hands of specialists from many other fields. It needed, says Plewe, not the quick stroke of a surgeon's knife, but the patient moulding that comes from a blacksmith's hammer. This Hettner provided and the *Geographische Zeitschrift* was his anvil.

There is an admirable summary of Hettner's concept of the field of geography on pages 22-23. Plewe suggests that his most original service to geography was the solution of the problem of providing a bridge between physical nature and human culture, and between the rigid laws of nature and the freedom of human choice. Hettner's solution is set out on pages 23 and 24. The completeness of Hettner's conceptual structure of geography has not satisfied all. He has his critics; but, as Plewe emphasises, there is not one amongst them who, in assailing his views, 'does in fact not stand firmly on Hettner's own shoulders'.

In the latter part of his career Hettner's interests and substantive writings revealed a growing concern with human geography. Plewe finds his *Der Gang der Kultur über die Erde* 'perhaps his most attractive work'. Plewe's conclusion is that Hettner was geography's greatest methodologist. He created the unity of geography, giving it an internal form and structure which clearly differentiates it externally from all other disciplines.

It is a German custom to pay homage to its scientific leaders by reviewing their labours, their contributions to their discipline and their place within it. It is a very worthwhile custom and one which could well be followed to advantage in other countries. There is much scope for similar little commemorative volumes to English-speaking geographers of note.—KENNETH B. CUMBERLAND

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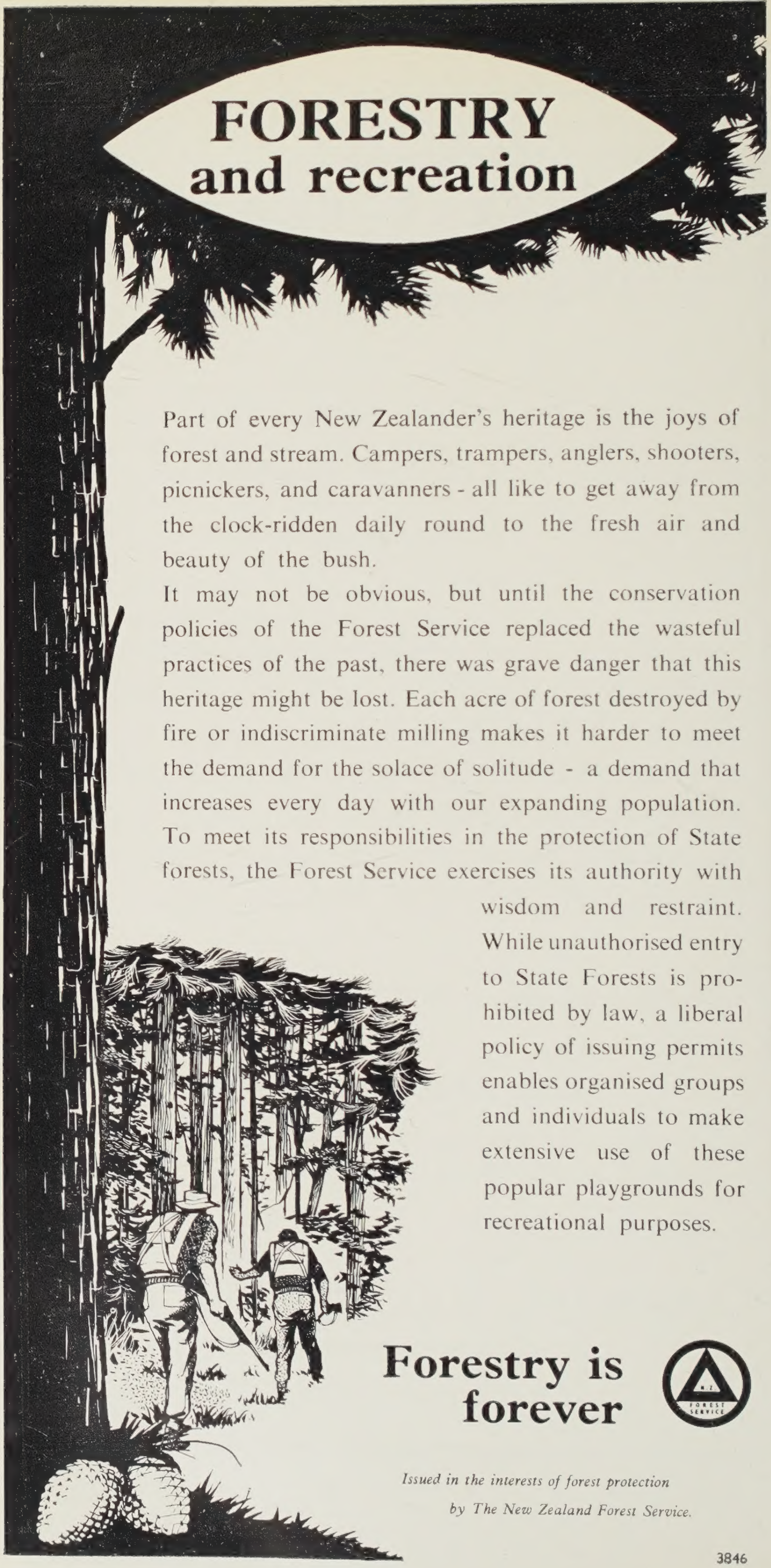

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